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Overview

Introduction

This appendix describes the **Economics** component. The goal of the **Economics** component is to compute stage-aggregated damage. Stage-aggregated damage functions are one of the three primary functions used to construct a damage-probability function. The other two functions are discharge-exceedance probability and stage-discharge. Integration of the damage-probability function produces expected annual damage. **Economics** is one of several components within the HEC-FDA Program. The program includes the following components:

- **Configure**. Define the study configuration including plans, years, streams, and reaches.

- **HydEng**. Enter or import water surface profiles, exceedance probability functions, stage-discharge rating functions, and levee parameters.

- **Economics**. Configure the damage categories, occupancy types, structure modules, structure inventories, and enter or compute stage-aggregated damage functions.

- **Evaluation**. Compute expected annual damage and display reports. You must configure the study and enter or compute the probability, rating, and damage functions before expected annual damage can be calculated.

The aggregated damage functions must be derived at the "index location" as defined under **Configure/Study Damage Reaches**. One stage-aggregated damage function must be computed for each plan, year, stream-reach, and category. In other words, for a given plan, year, stream-reach, and damage category, there is one stage-aggregated damage function. Usually, this function is computed but it may be entered directly if it has been computed using other tools. The function represents total damage and is the sum of the damage inflicted to three components:

- Structure
- Contents
- Other (such as outbuildings, landscaping, etc.)

The computation of expected annual damage utilizes only the stage-total aggregated damage function and not the individual components such as structure damage. Also, the program's GUI allows viewing only the total damage function.

Input Data Requirements

Before computing stage-aggregated damage, you must define several items including configuration items, water surface profiles, occupancy types, and structure attributes. It is also helpful to define the discharge-exceedance probability and stage-discharge functions. The configuration items define the basic study components such as plan, year, stream-reach, and category. The water surface profiles facilitate aggregation of damage from a single structure to the index location. The occupancy types describe depth-damage functions and some global structure parameters. The structure attributes define the parameters necessary for computing stage-damage for each structure. The discharge-exceedance probability and stage-discharge functions are used to determine the span of stages at the index location for which aggregated damage is computed.

Study Configuration

For the study configuration, you must define at least one plan, year, stream-reach, and damage category. It is advantageous to define as much of the study configuration data as possible at the beginning of the study. This allows merging data sets and more consistent generation of database record identifiers. The **Structure Modules** is also a configuration item although it (as well as damage categories) is listed under the menu item **Economics**. HEC-FDA assumes the **Base** module. You may not need additional modules.

Water Surface Profiles

To aggregate damage from each structure to the index location, the HEC-FDA program uses water surface profiles. The aggregation utilizes one of two possible profile definitions:

(1) The normal water surface profiles entered in the **HydEng** component, or

(2) The "SID reference flood" water surface profile.

If one of these two profiles is not defined, HEC-FDA cannot compute aggregated damage. The normal water surface profiles consist of eight profiles which are typically computed using HEC-2 or HEC-RAS. The "SID reference flood" water surface profile is a single profile that would represent a "typical" flood event. The old HEC-SID program used this single profile. You may import existing SID input data sets which contain this profile.

Occupancy Types

Occupancy types describe functions and parameters applicable to a class of structures. For example, one occupancy type may describe all single family, one story, wood-frame, without-basement, residential structures. This occupancy type is associated with one damage category and contains the depth-percent damage functions for structure, content, and other damage. It also contains the following global parameters:

(1) the ratio of content value to structure value,

(2) the ratio of other value to structure value,

(3) uncertainty parameters in first floor, structure value, content value, and other value.

The ratios of content and other values are used for any structure of this occupancy type. However, you may enter a content (and/or other) value for each structure and it will override the global value entered with the occupancy type.

Structure Attributes

Structure attributes define the parameters necessary for computing stage-damage at each structure. The following are required attributes:

(1) structure properties such as the first floor elevation, structure value, content value, etc.

(2) location properties such as stream, bank, stream station, UTM coordinates.

(3) class definitions such as damage category, occupancy type, structure module.

You may enter additional, optional structure attributes which provide information but are not used in calculations.

Discharge-Exceedance Probability and Stage-Discharge Functions

Stage-aggregated damage is computed for a range of stages at the index location. HEC-FDA computes this range by evaluating the extremes of discharge in the discharge-exceedance probability function, and interpolating the stage from the stage-discharge function for those extreme discharges. If the probability and/or stage-discharge functions have not been entered into the database, HEC-FDA determines the extremes from the water surface profiles and the associated probabilities.

Calculation of Stage-Aggregated Damage

Once all of the above parameters are defined, you may compute stage-aggregated damage for one or more combinations of plan and year. The computed functions are then used in the computation of expected annual damage. If there are changes to any of the parameters such as a structure's first floor elevation, you must re-compute stage-aggregated damage and then expected annual damage for all plan/year combinations that are dependent upon that structure.

HEC-FDA performs the following operations when you select a plan/year combination and press the compute button.

(1) For each reach, HEC-FDA calculates the range of stages at the index location. The stages represent the range from very frequent to very infrequent events. Additional ranges are added for risk-based analyses. HEC-FDA then calculates the interval between ordinates in "nice" units (1, 2, or 5 multiplied by 10 raised to some power).

(2) For the selected plan/year, HEC-FDA filters the structures using the structure module assignments so that it will process only those structures which are assigned to the selected modules.

(3) HEC-FDA processes each of the filtered structures. It determines the damage category, occupancy type, reach, and computes stage-aggregated damage at each of the tabulation stages which were determined in step 1. The tabulation stages are transformed to the structure location using either the water surface profiles or the SID reference flood water surface profile.

(4) The stage-damage for one structure is aggregated to the index location for the structures reach and category. During calculations, the aggregated functions are stored in memory.

(5) After all of the filtered structures are processed, the stage-aggregated damage functions are stored in the HEC-FDA database files.

Direct Entry of Stage-Aggregated Damage

To directly enter stage-aggregated damage by plan, year, stream-reach, and category, you have to define configuration items such as plan, year, stream-reach, and category. However, you do not enter water surface profiles, occupancy types, or structure attributes. You could enter this data for other purposes (such as water surface profiles for hydrologic and/or hydraulic calculation purposes), or for storing information for later use (such as structure attributes). However, the process of directly entering the aggregated damage functions ignores this data. Use of this method is generally limited to the entry of functions developed with other tools such as spreadsheets using risk-based add-ins. If you directly enter stage-aggregated damage and then later computes stage-aggregated damage, the computed results will override the directly entered functions. Therefore, you must utilize only one methodology during a study.

Entering Economic Data in HEC-FDA Data Base

Introduction

You may enter structure inventory data into the HEC-FDA database using two methods:

(1) Enter data in either a "form" or a "table" format within the HEC-FDA interface.

(2) Import data from either SID input data files or from Text files with tab delimiters.

The main body of this document describes entering data using the program interface (GUI, or graphical user interface). This section describes importing data from "tab delimited" text files and SID input data files.

Importing Data From HEC-SID Data Files

HEC-FDA can import data from HEC-SID (Hydrologic Engineering Center's "Structure Inventory for Damage Analysis" program) input files. The import capability has several requirements and features outlined below:

- All of the data must be in one file. These include the normal "job" records such as DC (damage category), and DR (damage reach), damage function records such as DF, DP, PC, DD (function name, depth, percent damage, dollar damage), and structure inventory records such as SL, SD, SO(first floor stage, value of structure, contents, and other, etc.).

- Do not include damage category records for separating contents damage from structure damage (CC records and associated DC records for contents only).

- Optionally enter damage reach index location station in field DR.10 (columns 73-80 of the DR record).

- Optionally enter the structure stream station in field SO.9 (columns 65-72 of the SO record).

- HEC-FDA will calculate the range of stream stations (river miles) for each reach if the station is entered in the SO.9 field for each structure. Upon completion, the beginning and ending stations are stored with the reach specifications in the HEC-FDA database.

HEC-FDA determines all combinations of the depth-damage functions from the structure inventory and generates occupancy types from these. The occupancy type names are formed by concatenating the SID damage function names. The same functions for one structure cannot be used for another that is in a different damage category.

Importing Data From "Tab Delimited" Text files

Primary Data

HEC-FDA reads several basic data types. These data types are the primary reason for importing data but they may reference other data types that are assumed to already exist. For example, structure information is primary data, yet each structure references a stream which is assumed to already be defined. However, as part of the import process, HEC-FDA will add records (if they don’t exist) to the database for some related data (such as streams) to facilitate successful transfer of data. HEC-FDA imports the following data:

- Damage Categories (damage category name). The names must be unique.

- Occupancy Types (occupancy type name). The names must be unique and be assigned to a damage category. Each category may contain one or more occupancy codes. (Example, category "SF Residential" may have the occupancy codes "1SNB", "1SWB", "2SNB", "2SWB", etc.). Occupancy codes contain the depth-damage functions and each code represents a type of dwelling. For example, separate occupancy codes could represent the following:

    - single family, no basement, wood frame construction;
    - single family, with basement, masonry construction;
    - public building, masonry construction, school; etc.

- Structures (Structure name). Unique name for each structure. At entry, a structure must be assigned a stream, damage category, occupancy type, and structure module (base is default). Other parameters may be entered later before calculations. Structure information includes items such as value of structure, contents, and "other,” first floor elevation, and stream station (river mile).

Related Data

As mentioned above, primary import data may reference other data types. HEC-FDA will add records to the database for the following data if they have not been previously defined at the time of import:

- Stream (Stream Name)

- Reach. The damage reaches are defined by stream, station (river mile), and stream bank (left, right, or both). The HEC-FDA program assigns each structure to a reach using either the structure's stream, station (river mile), and bank (left or right) or the SID reach name. For import purposes, if the SID reach name in an import data field does not exist (either from SID input data files or from ASCII text files), HEC-FDA will create a new damage reach of that name with stations set to undefined.

- Damage Category (Damage Category Name).

- Occupancy type (Occupancy type name). HEC-FDA will add occupancy codes for each code referenced by the imported structure if that code does not exist. The occupancy codes that are added contain no depth-damage functions, etc. You will have to edit the functions or import them later. When importing SID input data, HEC-FDA develops a list of occupancy codes by concatenating the depth-damage function names for structure, content, and other. The analyst may later change the internally generated names to something more meaningful.

Requirements for Importing Economics Data From Text File

HEC-FDA imports data from a text file which contains "tab delimited" fields. The file is typically created in a spreadsheet program. The sheet is saved as "Text (Tab delimited), (*.txt)". The file contains a "tab" between each column of data. The first line (row) of the file is a key record which contains field names for each column of data. The field name in column one is a keyword which identifies the data type. If the sheet contains data that HEC-FDA cannot import (such as structure square footage), you would leave the field name cell blank or enter a descriptor which is not an HEC-FDA field name.

Types of Economic Data and Associated Keywords. HEC-FDA can import three types of data: damage categories, occupancy types, and structure inventory. Column one of row one must contain one of the following keywords. HEC-FDA uses the keyword to determine which type of data will be imported. Multiple types of data may be entered in one file. The first row preceding a new data type must contain the keyword in column one and the field names in subsequent columns of the same row. The three types of economic data that can be imported and the associated keywords are:

Keyword	Type of Data
Cat_Name	Damage Categories
Occ_Name	Occupancy Types
Struct_Name	Structure inventory

Format of Data and Field Names. The line of data which contains the keyword and field names must precede any data associated with it. The following rules apply to the keywords and data:

- Data for the keyword must be unique for each record (unique category names, unique occupancy names, unique structure names).

- The keyword and associated data must be entered. For example, when importing damage categories, the keyword "Cat_Name" must be entered in column one of row one and a damage category name must be entered in column one of each subsequent row. Other fields may be omitted unless required by the FDA program. For example, each structure must be assigned to a damage category so each structure entry must be assigned a damage category name. For occupancy types, a blank cell in a column is treated as if the previously known occupancy type is entered.

- Data fields are separated by the "tab" delimiter. A typical way to create this file is to enter the data in a spreadsheet such as Excel or Quattro Pro version 8. From the spreadsheet, first save the file in spreadsheet or workbook format and then save the current worksheet file as "Text (Tab-delimited) (*.txt)". The HEC-FDA program assumes the extension ".txt" although you can use any extension you like.

- Other than the "key word" data field, other fields may be entered in any order and columns containing data not retrieved by the HEC-FDA program can be interspersed anywhere.

- The field names are entered on the same line (row) as the "Key Word".

- All data may be in one file but it is advisable to keep the structures separate from the occupancy codes strictly from a visual standpoint and to maintain integrity in the field formatting and width.

Field Names for Damage Categories

The following Field Names (identifiers) are used to import damage category data:

Field Name	Description
Cat_Name	Damage category name (16 characters max.). Must be entered in the first column.
Cat_Description	Description of this damage category (64 characters max.)
Cost_Factor	Price Index for this category. Overrides the

global factor entered for the study. If left blank, the price index for this category is set to undefined.

Table 1 illustrates the entry of damage categories in a spreadsheet. This worksheet can be saved as “tab-delimited text” and imported into the HEC-FDA database.

Table 1 Example Damage Categories in Spreadsheet

Cat_Name	Cat_Description	Cost_Factor
Agriculture	Crop Composite of 50% Strawberry, 40% Lettuce, 10% Cauliflower	1.010
Commercial		1.010
Emergency Costs	Flood disaster relief	1.010
Flood Insurance	Flood Insurance Savings	1.000
Greenhouses		1.010
Public		1.010
Residential		1.010
Warehouses		1.010

Field Names and Parameter Codes for Occupancy Types

Field Names. The following field names (identifiers) are used to import occupancy type data. These Field Names must be entered in the first row.

Field Name	Description
Occ_Name	Occupancy Type name (16 characters max.). Must be entered in the first column.
Cat_Name	Damage category name (16 characters max).
Occ_Description	Description of this Occupancy type (64 characters max.).
Parameter	Parameter Code from list below.
Start_Data	Code name indicating the first column of data in depth-damage functions and structure uncertainty.

Parameter Codes. Parameter codes identify the type of data entered in the current row. The row may contain depth, damage, standard deviation in damage, or structure uncertainties (such as for first floor stage, structure value, content value, or other value). All data pertinent to this parameter code are entered in columns to the right of the parameter code. Damage data for depth-damage functions may be entered in percent (use the parameter code) or in thousands of dollars (append the parameter code with a “$”). For example, damage for the depth-percent damage function for structure damage uses the code ”S” whereas if the damage is in thousands of dollars it uses the code

"S$". The parameter code for damage includes a letter indicating which component of damage is entered (S for structure, C for content, O for other). The parameter code for standard deviation of error (or maximum/minimum for triangular distributions) includes the component (S for structure, etc.) and the distribution (blank is none, N is normal, L is log-normal, T is triangular, and U is uniform). The following table lists the valid parameter codes and associated descriptions are:

Parameter Code	Description
STAGE	Depth for depth-damage function. May be entered only once and then the same depths are used for all trailing functions.
S	Damage to structure in percent for depth-damage function. Use S$ for dollar damage.
C	Damage to contents in percent for depth-damage function (e.g., inventory). Use C$ for dollar damage.
O	Damage to "other" in percent for depth-damage function (e.g., equipment). Use O$ for dollar damage.
SN	Standard error in structure damage, normal distribution.
CN	Standard error in content damage, normal distribution.
ON	Standard error in "other" damage, normal distribution.
STU	Standard error in structure damage above the curve, triangular distribution.
STL	Standard error in structure damage below the curve, triangular distribution.
CTU	Standard error in content damage above the curve, triangular distribution.
CTL	Standard error in content damage below the curve, triangular distribution.
OTU	Standard error in "other" damage above the curve, triangular distribution.
OTL	Standard error in "other" damage below the curve, triangular distribution.
SL	Standard error in structure damage, log-normal distribution.

CL — Standard error in content damage, log-normal distribution.

OL — Standard error in "other" damage, log-normal distribution.

SU — Standard error in structure damage, uniform distribution.

CU — Standard error in content damage, uniform distribution.

OU — Standard error in "other" damage, uniform distribution.

STRUCT — Distributions and errors for the parameters associated with structures (first floor, structure value, content value, "other" value). There are four columns for each uncertainty parameter in the preceding order. The columns contain the following data:

(1) distribution type (N is normal, LN is log-normal, T is triangular, U is uniform).

(2) median value (left blank for first floor and structure value). For contents and other, this is the ratio of contents (or other) to structure value.

(3) standard deviation of error for normal or log-normal or the minimum value in the triangular distribution.

(4) maximum value in the triangular distribution.

The four columns of uncertainty information for the first floor stage are entered first followed by the structure value, etc.

Table 2 illustrates the entry of occupancy types in a spreadsheet. This worksheet can be saved as “tab-delimited text” and imported into the HEC-FDA database.

Table 2 Example Occupancy Codes in Spreadsheet

Occ_Name	Cat_Name	Occ_Description	Parameter	Start_Data											
1	Residential	One Story Single Family Res	Stage	-3	-2	-1	0	1	2	3	4	5	6	7	8	9
1			S	0	0	0	8	14	20	26	29	30	41	43	44	45
1			SN	0	0	0	1.6	2.8	4	5.2	5.8	6	8.2	8.6	8.8	9
1			C	0	0	0	11	17	32	35	37	41	45	50	55	60
1			CN	0	0	0	2.2	3.4	6.4	7	7.4	8.2	9	10	11	12
1			Struct	N		0.03		N		5		N	35	15.8		
2		Two Story Single Fam Res	S	0	0	0	5	9	13	18	20	22	24	26	30	34
2			C	0	0	0	7	10	18	23	28	33	39	44	50	54
2			SN	0	0	0	1	1.8	2.6	3.6	4	4.4	4.8	5.2	6	6.8
2			CN	0	0	0	1.4	2	3.6	4.6	5.6	6.6	7.8	8.8	10	10.8
2			Struct	N		0.03		N		5		N	35	15.8		

Field Names for Structures

Field Names. The following field names (identifiers) are used to import structure data. These field names must be entered in the first row. The keyword “Struc_Name” must be entered in the first column. All other Field Names may be entered in any order. Not all field names are required. The required field names (and associated data) are: “Struc_Name”, “Cat_Name”, “Stream_Name”, and “Occ_Name”. If only some of the data is known at the time of import, the analyst needs only import the known data and let the others revert to a default value.

Field Name	Description
Struc_Name	Structure name (must be unique and is required). Maximum of 16 characters.
Cat_Name	Damage category name (required). Maximum of 16 characters.
Stream_Name	Stream name (required). Maximum of 16 characters.
Occ_Name	Occupancy code (required). Maximum of 16 characters.
Station	Station (or river mile).
Bank	Bank location (left or right) assumed left.
Year	Year in service(assumed missing).
Struc_Val	Structure value ($1,000).
Cont_Val	Content value ($1,000), default missing and ratio from occupancy type is used.
Other_Val	Other value ($1,000), default missing and ratio from occupancy type is used.
1F_Stage	First floor stage (elevation).
Grnd_Stage	Stage (elevation) of ground at structure.
Found_Ht	Foundation height (distance from ground to first floor).
Begin_Damg	Beginning damage depth (assumed undefined and not used).
Street	Street address of structure.
City	City.

State	State.
Zip	Zip code.
North	Northing coordinate at structure.
East	Easting coordinate at structure.
Zone	Zone for the above coordinates.
Num_Struct	Number of identical structures this one entry represents.
Notes	Miscellaneous notes. HEC-FDA allows multiple lines of notes. Spreadsheet programs do not accept the “Enter” key as a character within a cell. To insert a line feed, use the key sequence “Alt-20" (press and hold the “Alt” key, then press and release the 2 and the 0 (zero) key on the numeric keypad).
Mod_Name	Module name (assumed base).
SID_Rch	The SID reach name.
SID_Reffld	The SID reference flood elevation.

Example Structure Data Stored in a Spreadsheet. Table 3 illustrates structure inventory data stored in a spreadsheet. In this example, only some of the data is shown. You can easily add additional columns of data within the spreadsheet. If the first row contains a field name that is blank or is an unrecognizable field name, HEC-FDA will ignore data in that field. This is useful for entering data such as structure square footage and unit cost per square foot which enables the calculation of structure value as a function of these parameters.

Table 3 Example Structure Data Stored In a Spreadsheet

Struc_Name	Cat_Name	Stream_Name	Occ_Name	Station	Bank	Year	Struc_Val	Cont_Val	1F_Stage	Street	East
1	Residential	flint river	1	100.362	RIGHT	1900	26.0	9.1	182.17	621 ALBERT CT	2297845.00
2	Residential	flint river	1	100.332	RIGHT	1900	21.5	7.5	182.41	620 ALBERT CT	2297841.25
3	Residential	flint river	1	100.356	RIGHT	1900	42.1	14.7	183.36	619 ALBERT CT	2297882.25
4	Residential	flint river	1	100.331	RIGHT	1900	30.4	10.6	183.23	618 ALBERT CT	2297881.50
5	Residential	flint river	1	100.358	RIGHT	1900	47.2	16.5	181.76	617 ALBERT CT	2297942.75
6	Residential	flint river	1	100.332	RIGHT	1900	42.7	14.9	183.15	616 ALBERT CT	2297932.00
7	Residential	flint river	1	100.359	RIGHT	1900	34.7	12.1	183.07	615 ALBERT CT	2298000.75
8	Residential	flint river	1	100.332	RIGHT	1900	30.7	10.7	181.95	614 ALBERT CT	2297998.75
9	Residential	flint river	1	100.360	RIGHT	1900	39.2	13.7	182.97	613 ALBERT CT	2298061.50
10	Residential	flint river	1	100.333	RIGHT	1900	24.5	8.6	181.89	612 ALBERT CT	2298072.25
11	Residential	flint river	1	100.358	RIGHT	1900	24.2	8.4	181.9	611 ALBERT CT	2298132.00
12	Residential	flint river	1	100.334	RIGHT	1900	26.9	9.4	182.57	610 ALBERT CT	2298137.75
13	Residential	flint river	1	100.360	RIGHT	1900	33.4	11.7	182.47	609 ALBERT CT	2298163.50
14	Residential	flint river	1	100.332	RIGHT	1900	26.9	9.4	182.72	608 ALBERT CT	2298196.25
15	Residential	flint river	1	100.354	RIGHT	1900	32.3	11.3	181.76	607 ALBERT CT	2298249.50
16	Residential	flint river	1	100.334	RIGHT	1900	34.5	12.0	183.4	606 ALBERT CT	2298253.25
17	Residential	flint river	1	100.358	RIGHT	1900	27.5	9.6	181.91	605 ALBERT CT	2298281.75
18	Residential	flint river	1	100.331	RIGHT	1900	27.2	9.5	182.43	602 ALBERT CT	2298316.75
19	Residential	flint river	1	100.349	RIGHT	1900	43.7	15.3	182.24	601 ALBERT CT	2298370.75
20	Residential	flint river	1	100.330	RIGHT	1900	25.8	9.0	181.85	600 ALBERT CT	2298368.75
21	Residential	flint river	1	100.848	RIGHT	1900	30.0	10.5	180.64	624 ALICE AV	
22	Residential	flint river	1	100.848	RIGHT	1900	7.2	2.5	181.06	622 ALICE AV	
23	Residential	flint river	1	100.848	RIGHT	1900	37.5	13.1	179.84	537 ALICE AV	2298232.25
24	Residential	flint river	1	100.848	RIGHT	1900	30.3	10.6	179.54	535 ALICE AV	2298287.25
25	Residential	flint river	1	100.849	RIGHT	1900	50.0	17.5	179.78	533 ALICE AV	2298342.50
26	Residential	flint river	1	100.844	RIGHT	1900	44.3	15.5	180.56	531 ALICE AV	2298409.75
27	Residential	flint river	1	100.844	RIGHT	1900	16.2	5.7	179.43	529 ALICE AV	2298464.50
28	Residential	flint river	1	100.844	RIGHT	1900	11.2	3.9	179.92	527 ALICE AV	2298501.50
29	Residential	flint river	1	100.846	RIGHT	1900	8.9	3.1	181.33	523 ALICE AV	2298586.00
30	Residential	flint river	1	100.845	RIGHT	1900	4.2	1.5	182.88	521 ALICE AV	2298649.25
31	Residential	flint river	1	100.845	RIGHT	1900	5.0	1.7	182.88	519 ALICE AV	2298683.50
32	Nonresidential	flint river	630	100.844	RIGHT	1900	25.0	0.0	184.63	515 ALICE AV	2298763.50
33	Residential	flint river	1	100.828	RIGHT	1900	13.2	4.6	180.11	514 ALICE AV	2298796.75

Calculation Procedures

Introduction

This section describes and illustrates the calculation procedures used by HEC-FDA to compute stage-aggregated damage at the index location. The calculations require you to already have entered supporting data. Other sections describe data entry and alternative data entry methods. HEC-FDA follows the general procedures described previously and illustrated here. You select a plan/year combination for which calculations are performed. If you select more than one plan/year combination, HEC-FDA processes each one independently and loops through all selected combinations.

For discussion purposes, an imaginary study is created on Silver Creek. The study area is divided into five reaches as shown in Table 4. There is an overlap of reaches SC 2L and SC 2La. That is, they represent the same stream (Silver Creek), station range (20.002 through 29.998), and bank (Left). Discussions later on will illustrate situations where this can be used to the analyst's advantage. For now, the discussion will center on computing stage-damage for several structures (located on the right bank) within reach SC 2R. The index point is located at station 25.000 (river mile 25.000). The stage-damage function for each structure is aggregated to the index location.

Table 4 List of Reaches For Silver Creek

Reach Name	Beginning Station	Ending Station	Bank	Index Location Station	Description
SC 1	20.000	20.001	Left	20.000	Bottom of Study area. RM 20.000
SC 2L	20.002	29.998	Left	25.000	Reach SC 2L, Silver Crk. Left bank
SC 2La	20.002	29.998	Left	25.000	Reach SC 2La, Silver Crk. Parallels Reach SC 2L. Protected by Levee.
SC 2R	20.000	30.000	Right	25.000	Reach SC 2R, Silver Crk. Right bank.
SC 3	29.999	30.000	Left	30.000	Top of Study area. RM 30.0

Setting Up the Calculation Procedures

Initially, HEC-FDA builds into memory storage locations for the stage-aggregated damage functions. It determines the total number of reaches for all streams and the number of categories. For each reach, it determines the range of stages required to cover the entire range of events from frequent to infrequent. It attempts to determine this range first by retrieving the discharge-exceedance probability and stage-discharge functions. If these are not available, it retrieves the water surface profile information. If this is not available, HEC-FDA cannot determine the required range of stages at the index location and the calculation procedures will not proceed.

To initialize and scale the stage-aggregated damage matrix, HEC-FDA must retrieve the discharge-exceedance probability and stage-discharge functions for reach SC 2R. Table 5 lists Log Pearson Type III Statistics for the Hypothetical Reach SC 2R. The number of years is the equivalent length of record and is a measure of the uncertainty in the statistics. HEC-FDA computes discharge-exceedance probability curve ordinates as shown in Table 6. Although these are generated from Log Pearson Type III Statistics, they could have been generated from either synthetic statistics or from graphical coordinates. For scaling, HEC-FDA uses the extreme ordinates of flow corresponding to probabilities 0.999 and .002 which represent return intervals of - I and 500 years. For reach SC 2R, the flows

Table 5 Log Pearson Type III Statistics For Reach SC 2R

Mean	3.000
Standard Deviation	0.200
Skew	0.4
Number of Years	50

Table 6 Discharge-Exceedance Probability Ordinates, Reach SC 2R

Probability	Discharge	95%	5%
0.999	312	240	378
0.990	393	315	464
0.950	496	413	571
0.900	567	483	646
0.800	675	587	758
0.700	770	679	859
0.500	970	869	1,080
0.300	1,243	1,115	1,403
0.200	1,456	1,297	1,670
0.100	1,834	1,606	2,168
0.040	2,377	2,028	2,927
0.020	2,833	2,369	3,595
0.010	3,335	2,734	4,355

of 312 and 4711 are used to determine the extreme stages for scaling. If risk analysis is used, then discharges corresponding to the 5% (6555 cfs) and 95% (240 cfs) confidence limit curves are used instead of the median values. For this example, it is assumed that risk analysis is not used and that the minimum range of stages is determined from the discharges of 312 cfs and 4,711 cfs. Figure 1 depicts the discharge-exceedance probability curve with confidence limits.

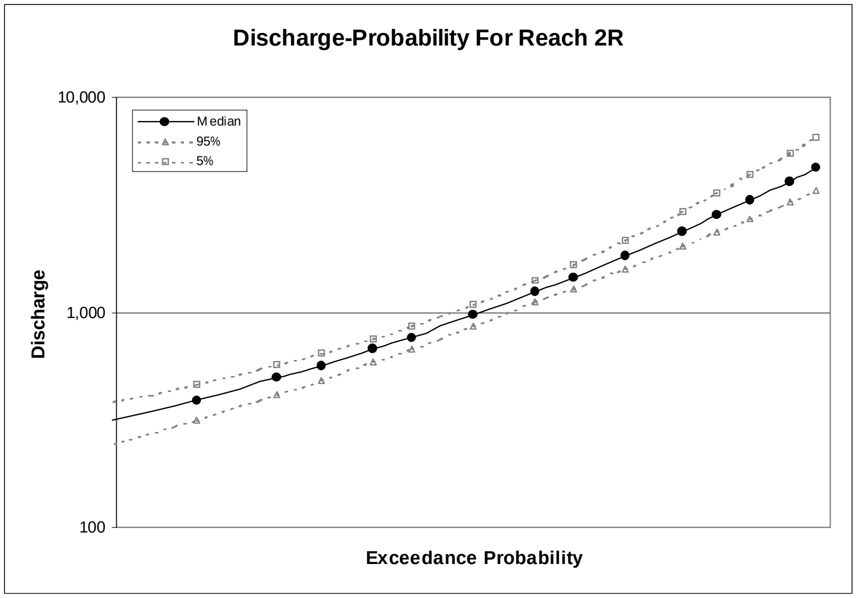

Figure 1 Discharge-Exceedance Probability Curve for Reach SC 2R

Once the discharge-exceedance probability curve is retrieved and the extreme discharge values are determined, the stage-discharge function is retrieved and used to determine the corresponding stages. Table 7 lists the stage-discharge ordinates for reach SC 2R. They were computed from water surface profiles. Assuming calculations are not using risk analysis, stages are interpolated from this table. The discharges of 312 cfs and 4,711 cfs correspond to stages of 206.42 and 234.00. HEC-FDA then calculates a range of stages that meet the following criteria:

Table 7 Stage-Discharge Function For Reach SC 2R

Discharge	Stage	-2 SD	+2 SD
0	200.00	200.00	200.00
970	220.00	218.75	221.25
1,456	225.50	223.91	227.09
1,834	227.80	226.06	229.54
2,377	229.70	227.84	231.56
2,833	230.80	228.88	232.73
3,335	232.00	230.00	234.00
4,081	233.00	231.00	235.00
4,711	234.00	232.00	236.00

- encompass the range of stages from 206.42 through 234.00 feet

- have an interval that is either 1, 2, or 5 times 10 raised to some power. For example, 2.0×10^{-1} creates an array of stages 0.2 feet apart.

- Have at least 20 but not more than 30 ordinates (this is an input option that can be changed).

For example, the stages in the stage-aggregated damage matrix for reach SC 2R are computed as:

- 30 ordinates

- Minimum stage is 206.0 feet

- Maximum stage is 235.0 feet

- Interval between stages is 1.0 feet

The program now allocates memory for the array of stages and additional space for the corresponding aggregated damage and uncertainty (which will be computed) for all damage categories and stores the stages in this block of memory. All reaches are processed in the same manor as reach SC 2R.

Typically, calculations utilize risk analysis. Figure 2 depicts the same stage-discharge function with confidence bands. To determine the required range of stages, a more extreme value (236.0 feet) is used that is two standard deviations away from the median instead of using the mean ordinate (234.0 feet).

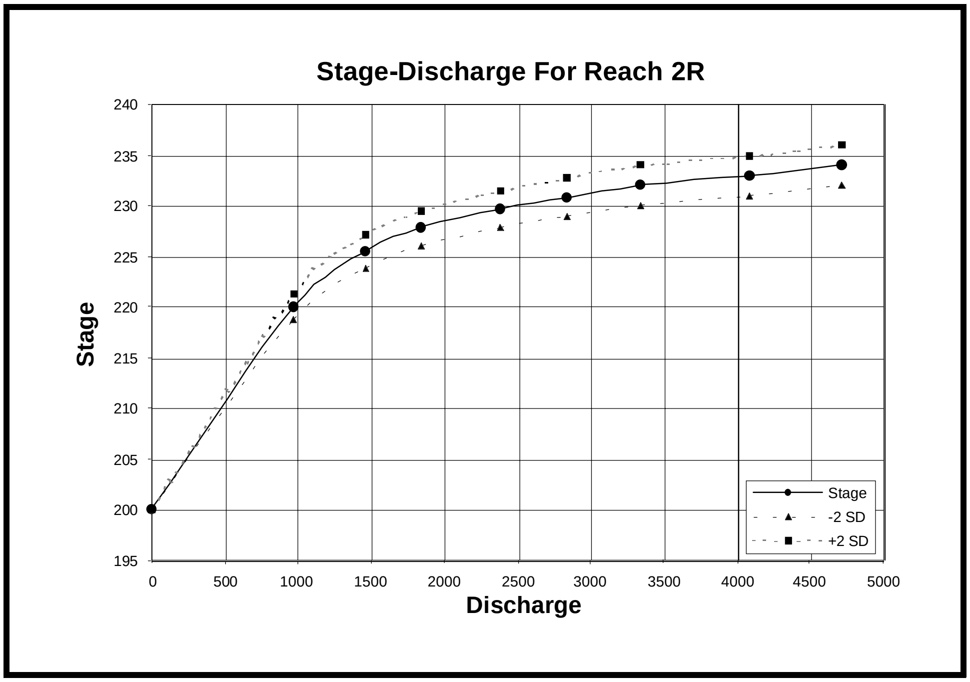

Figure 2 Stage-Discharge Function For Reach SC 2R

If the discharge-exceedance probability and/or stage-dischrge functions are not stored in the database, HEC-FDA determines the range of stages from the water surface profile information. However, the default profiles include only a range of probability starting at 0.50. The resulting stage range could easily start too high. For example, if the functions were not available for reach SC 2R, the use of profile information would result in an array of 20 stages ranging from 219.0 to 238.0 feet at an interval of 1.0 feet. If damage occurs at only infrequent events, this may be all right but the analyst should evaluate the suitability after computing stage-damage results.

Computing Stage-damage at Individual Structures Without Uncertainty

Introduction

Once memory is allocated for the stage-aggregated damage matrices and the range of stages is determined for all reaches and all damage categories, HEC-FDA begins processing all structures that meet the plan/year filter. The plan year filter selects all structures which belong to the same structure modules as defined in the **Structures Module Assignment** list. The assignment list is created by selecting one plan and one year and then checking each structure module that will be used for the selected plan/year. The **Base** module is always included although it may be an empty module (no structures assigned to this module). By default, each structure is assigned the **Base** module at data entry but it may be overridden. This section describes the processes and calculations at several structures which meet the plan/year filter.

Calculating the Assumed Water Surface Profile Elevations at the Structure

Stage-damage at one structure is computed by calculating the water surface profile stages at the structure, determining the depth of flooding, and calculating the damage using values (structure, content, other) and depth-damage functions. The assumed stages at the structure correspond to the stages in the stage-aggregated damage function at the index location after adjusting for the slope of the water surface profile(s) between the index location and the structure. If the calculations use the **Study Water Surface Profiles** (the eight standard profiles), the stages are adjusted using all eight profiles. If the SID reference flood water surface profile is used, then only one profile is used to adjust the stages.

Description of Sample Data - Profiles and Structures. Table 8 lists the water surface profile stages at three cross-sections (station 20.0, 25.0, and 30.0). Stages are tabulated under their associated probability. For example, at station 25.000 (river mile 25.000), the stage for the 0.01 probability event (100 year return interval) is 232.0 feet. Figure 3 graphically displays these same values. At the lower end of the study area (station 20.000), the profiles are relatively close compared to the upper end. The index location for reach “SC 2R” is at station 25.000.

Table 8 Stage Water Surface Profiles, Without Condition

Station	Invert	0.500	0.200	0.100	0.040	0.020	0.010	0.004	0.002
20.000	150.0	158.0	161.2	163.1	164.7	165.9	166.7	167.1	167.3
25.000	200.0	220.0	225.5	227.8	229.7	230.8	232.0	233.0	234.0
30.000	209.0	236.0	246.0	252.0	257.6	261.6	264.6	266.6	267.6

To illustrate the aggregation process, three identical structures are used to calculate damage - one at the index location (station 25.000), and one at each of the extreme limits of the study (station 20.000 and 30.000). Table 9 lists the appropriate characteristics for each structure. The first floor stage of each structure is located at the same stage as the 10% chance event. This will help illustrate several points about the calculations including using the eight water surface profiles as opposed to just the SID reference flood profile, having nonparallel profiles, and the

Table 9 Structure Characteristics For Aggregation

Characteristic	Structure		
Name	R001	R002	R003
Station	20.000	25.000	30.000
Structure Value	100	100	100
Content Value	---	---	---
Other Value	---	---	---
Bank	R	R	R
Category	SF Residential	SF Residential	SF Residential
Occupancy Type	Sfr1	Sfr1	Sfr1
Stream	Silver Creek	Silver Creek	Silver Creek
Module	Base	Base	Base
First Floor Stage	166.7	227.8	252.0

location of each structure as defined by the structure station. Each structure is valued at $100,000. The contents are valued at $50,000 and it is calculated using the global "ratio of content to structure value" which is defined within occupancy type Sfrl which also contains the depth-percent damage functions. All three structures are located on the right bank.

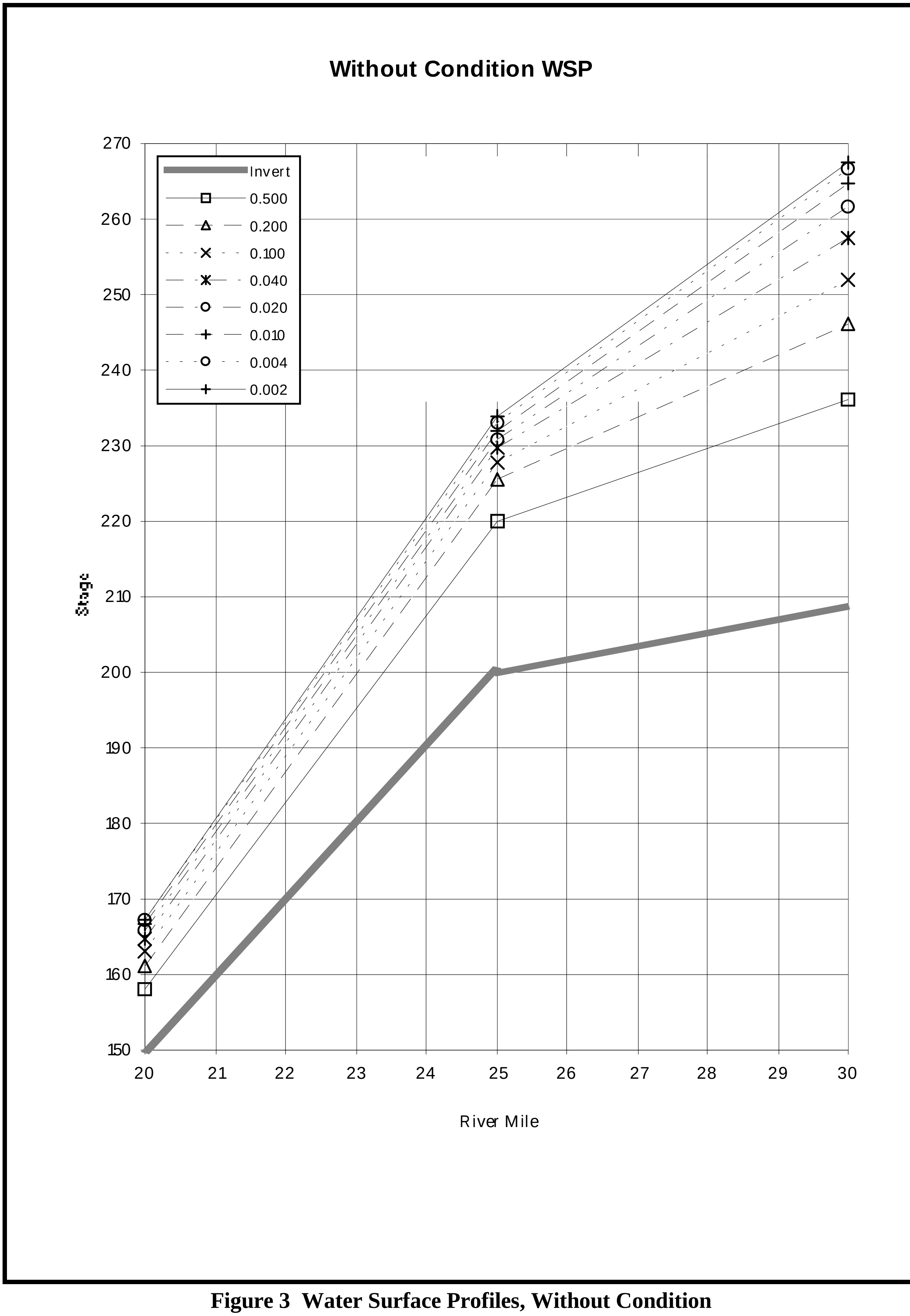

Figure 3 Water Surface Profiles, Without Condition

Calculating Sample Aggregation Stages. To determine the assumed (or aggregated) water surface stages at each structure, the water surface profiles are used to generate a family of profiles which correspond to the aggregation (tabulation) stages at the index location. For structure R002 which is located at the index location, the assumed water surface stages correspond exactly to the aggregation stages. For structures R001 and R003, the assumed stages at the structure must be calculated. For aggregation stages above the most rare event (.002) or below the most frequent event (.500), aggregation profiles are parallel to the adjacent probability profile (.002 and .500 probability events respectively). Aggregation profiles between these two extremes are calculated using simple ratios of the computed water surface profiles. Table 10 lists the aggregation profile stages at river mile 20.000, 25.000, and 30.000 which correspond to the three hypothetical structures. The lowest profile (.500 probability) is at stage 220.0 at the index location. All aggregation profiles below this minimum are parallel. For example, the .500 probability profile drops 62.0 feet from 220.0 at the index location to 158.0 feet at station 20.0. The same is true of the lowest aggregation profile which drops from 206.0 feet at the index location to 144.0 feet at station 20.00. Aggregation profiles are parallel to the 0.002 probability profile which reaches 234.0 feet at the index location. Aggregation profiles between 220.0 and 234.0 feet are computed using ratios. For example, for the aggregation profile which has a stage of 230.0 feet at the index location has stages of 165.03 and 258.69 at river mile 20.000 and 30.000 respectively. Figures 4 and 5 depict selected water surface profiles and aggregation profiles for river miles 20.000 through 30.000 and 25.000 through 30.000 respectively. Note that the aggregation profile for a stage of 210.0 at the index location actually crosses below the invert at river mile 20.000 because the water surface slope is much greater than the invert.

Table 10 Stages For Aggregation Profiles At Selected Locations

	River Mile (Station)		
	20.000	25.000	30.000
1	144.00	206.00	222.00
2	145.00	207.00	223.00
3	146.00	208.00	224.00
4	147.00	209.00	225.00
5	148.00	210.00	226.00
6	149.00	211.00	227.00
7	150.00	212.00	228.00
8	151.00	213.00	229.00
9	152.00	214.00	230.00
10	153.00	215.00	231.00
11	154.00	216.00	232.00
12	155.00	217.00	233.00
13	156.00	218.00	234.00
14	157.00	219.00	235.00
15	158.00	220.00	236.00
16	158.58	221.00	237.82
17	159.16	222.00	239.64
18	159.75	223.00	241.45
19	160.33	224.00	243.27
20	160.91	225.00	245.09
21	161.61	226.00	247.30
22	162.44	227.00	249.91
23	163.27	228.00	252.59
24	164.11	229.00	255.54
25	165.03	230.00	258.69
26	166.03	231.00	262.10
27	166.70	232.00	264.60
28	167.10	233.00	266.60
29	167.30	234.00	267.60
30	168.30	235.00	268.60

Aggregation Methodologies. There are two methods for aggregating stage-damage to the index location. The difference between the two is the source of water surface profiles. The sources are:

- The set of eight water surface profiles .

- The SID reference flood water surface profile.

The use of the eight profiles facilitates accurate calculations when profiles are not parallel. The use of the SID reference flood profile facilitates calculations using the old HEC-SID methodologies or calculations which require special circumstances . These circumstances might include:

- no profiles are available and water surface profiles as assumed to be flat.

- The profiles in the over-bank area are significantly different than those in the channel and a separate ”stream” is not used.

Results using the single SID reference flood profile are identical to using eight parallel profiles.

Data Requirements For Aggregation. The following data are required for aggregation using the eight water surface profiles:

- The structure must be assigned a valid station, bank, and stream.

- A set of water surface profiles must be entered under **HydEng/Water Surface Profiles** for the desired plan, year, and stream. The cross-section stationing must include the structure station.

- A damage reach must be defined under **Configure/Damage Reaches** which embodies location criteria of stream, bank, and beginning/ending stations that encapsulate those specified for the structure.

The following data are required for aggregation using the SID reference flood water surface profile:

- SID reference flood water surface stage at the structure.
- SID reference flood water surface stage at the index location.

SID reference flood water surface profile data is normally defined through import procedures and include importing either:

- An old SID input data.
- Tab-delimited text file

The SID reference flood stage may be entered in the GUI for the structure but **not** for the index location - it must be defined either through import or using commercial database software such as Visual dBASE.

Selecting the Aggregation Methodology. You select the desired methodology on the **Compute Reach Stage-Damage Function with Uncertainty** screen. To use the SID reference flood for aggregation purposes, the analysis must check the box "Use SID Ref Flood" for each plan/year combination. If the box is not checked, then the eight profiles are used. However, if the structure does not satisfy the data requirements for the desired methodology, HEC-FDA attempts to use the alternate methodology if data is available. This allows a mixture of methodologies within a selected plan/year. Figure 4 depicts the logic that HEC-FDA uses for determining the possible aggregation methodologies for the selected structure. When aggregating damage at a structure, HEC-FDA determines the possible methodologies using the logic of Figure 4 and then uses the logic of Figure 5 for calculation purposes.

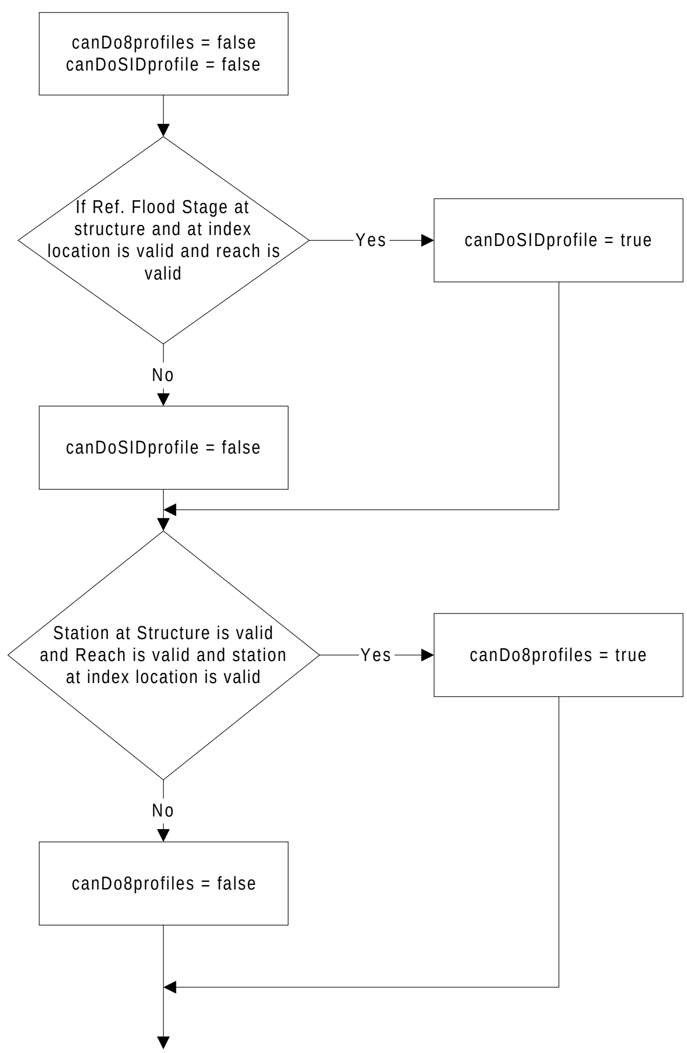

Figure 4 Logic For Testing Data Validity of Aggregation Methodologies

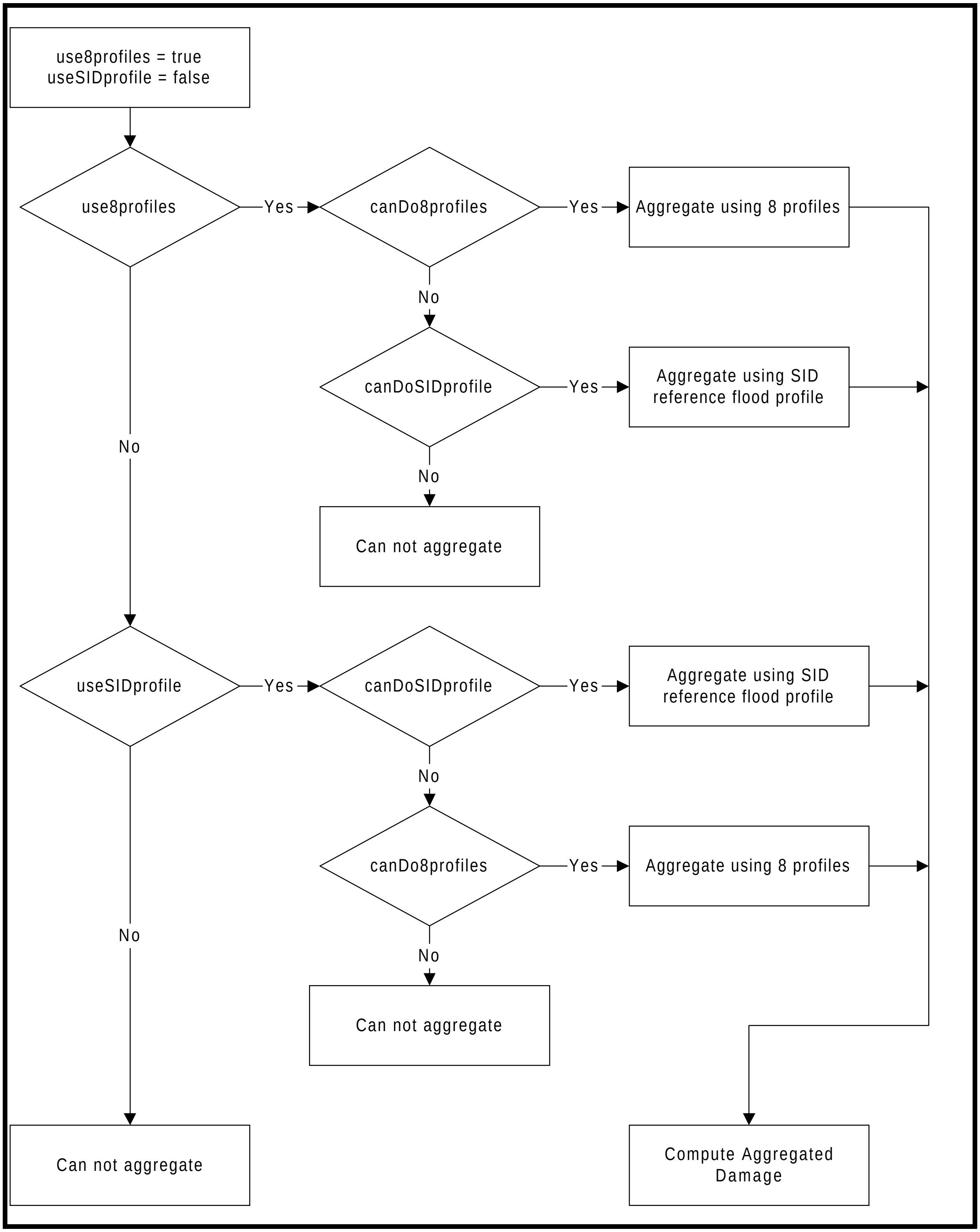

Figure 5 Logic For Determining Aggregation Methodology

Computing Damage For One Aggregation Stage Without Uncertainty

Overview. Damage is calculated at the structure for each of the stages listed in Table 10. In this example, the three structures are located at stations 20.000, 25.000, and 30.000 and the corresponding stages are tabulated. If a structure is located between any of these stations, appropriate interpolations must be made. The HEC-FDA computation algorithm assumes the highest stage first (235.00 at the index location) and descends to the lowest (206.00 at the index location). If calculated damage is zero for three consecutive stages, HEC-FDA assumes the zero-damage point has been reached and terminates calculations for the current structure. The calculation procedures accept as input the basic structure information as well as the associated data such as damage category and occupancy type. The following data is used as input to the calculations:

Structure Information

- Stream
- Station
- Bank
- Optional SID data (SID reach name, reference flood stage)
- First Floor Stage (or ground stage and foundation height)
- Beginning damage depth (optional)
- Damage Category Name
- Occupancy Type Name
- Depth-Direct Dollar Damage Functions for this structure (optional)
- Module
- Number of Structures
- Values (structure, content, other)
- Year in Service

Related Information from the following

- Damage Category
    - Price Index (optional)

- Occupancy Type
    - Depth-Damage Functions (structure and/or content and/or other) with optional uncertainty parameters.
    - Content to Structure Value Ratio (percent)
    - Other to Structure Value Ratio (percent)
    - Uncertainty Parameters
        - First Floor Stage
        - Structure Value
        - Content to Structure Value
        - Other to Structure Value

- Streams - Stream Name

- Damage Reaches
    - Stream
    - Bank (left or right)

- Stations - Beginning and Ending
- Reach Name (Used with SID reach names)

Other data/information may be entered for the structure, but it is not currently used in the computations. Some of the above data overlaps. For example, the analyst may define the first floor stage directly, or may define it using the ground stage and the foundation height.

The example data set includes the occupancy type "Single Family Residential, without basement". Table 11 lists the depth-percent damage functions for the Single Family, Residential, without basement ("SFR Wob") occupancy type. The functions are specified for structure and content but there is no damage to "other". Figure 8 depicts these same functions.

Table 11 Single Family, Residential, Without Basement Occupancy Type Damage Functions

Depth (feet)	Structure (percent damage)	Contents (percent damage)
-1	0	0
0	5	2
1	7	5
2	10	15
5	25	50
10	50	80
15	70	90
20	80	95

Figure 9 depicts the HEC-FDA stage-damage calculation procedure. The aggregation profiles (shown in Figure 6, Figure 7and Table 10) are used to compute the "Assumed Water Surface Elevation at the Structure" (or Aggregation Stage) which is used to compute the depth of flooding. Figure 9 depicts the process for one ordinate at one structure without using risk-based procedures.

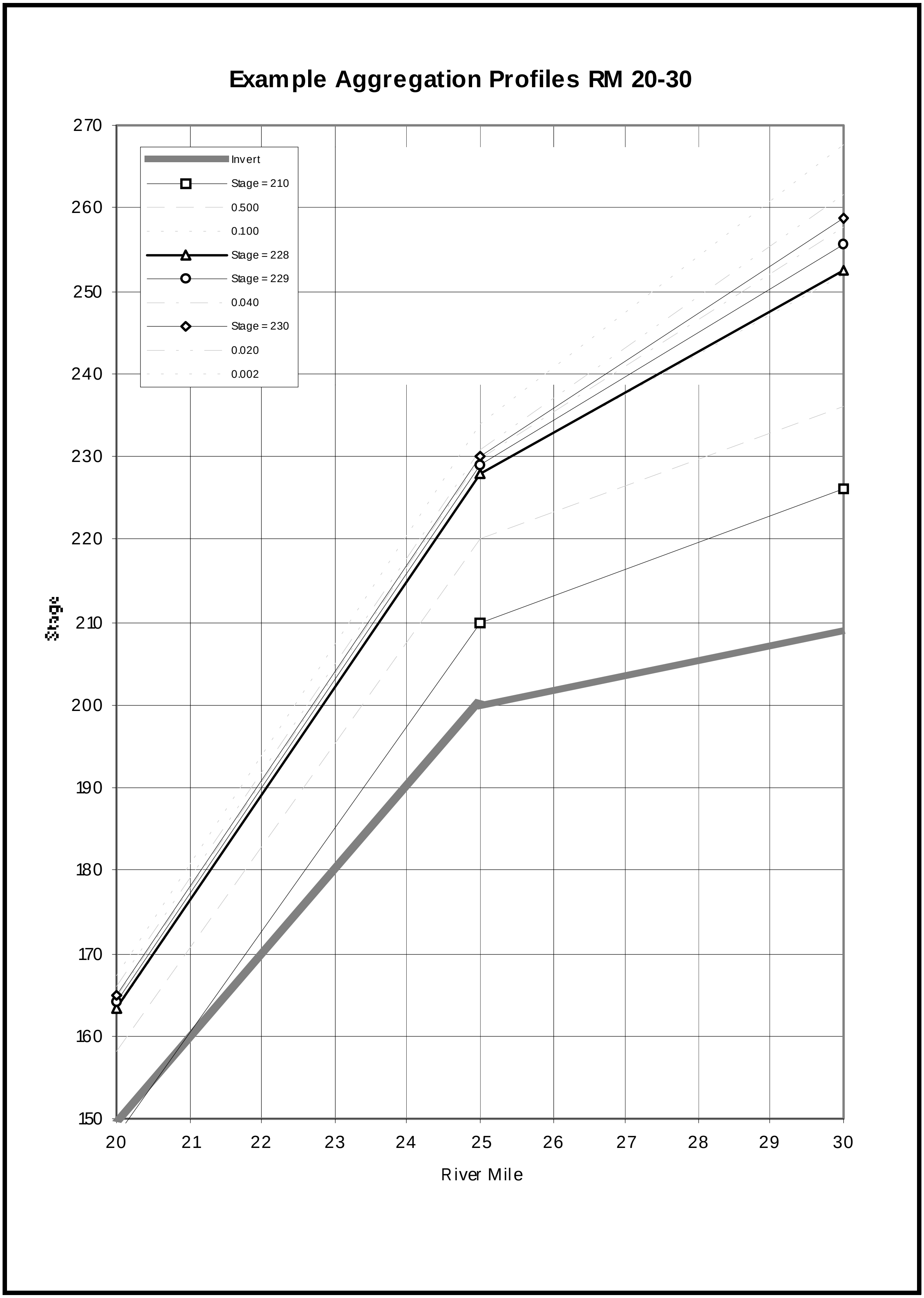

Figure 6 Selected Aggregation and Water Surface Profiles RM 20.00 - 30.00

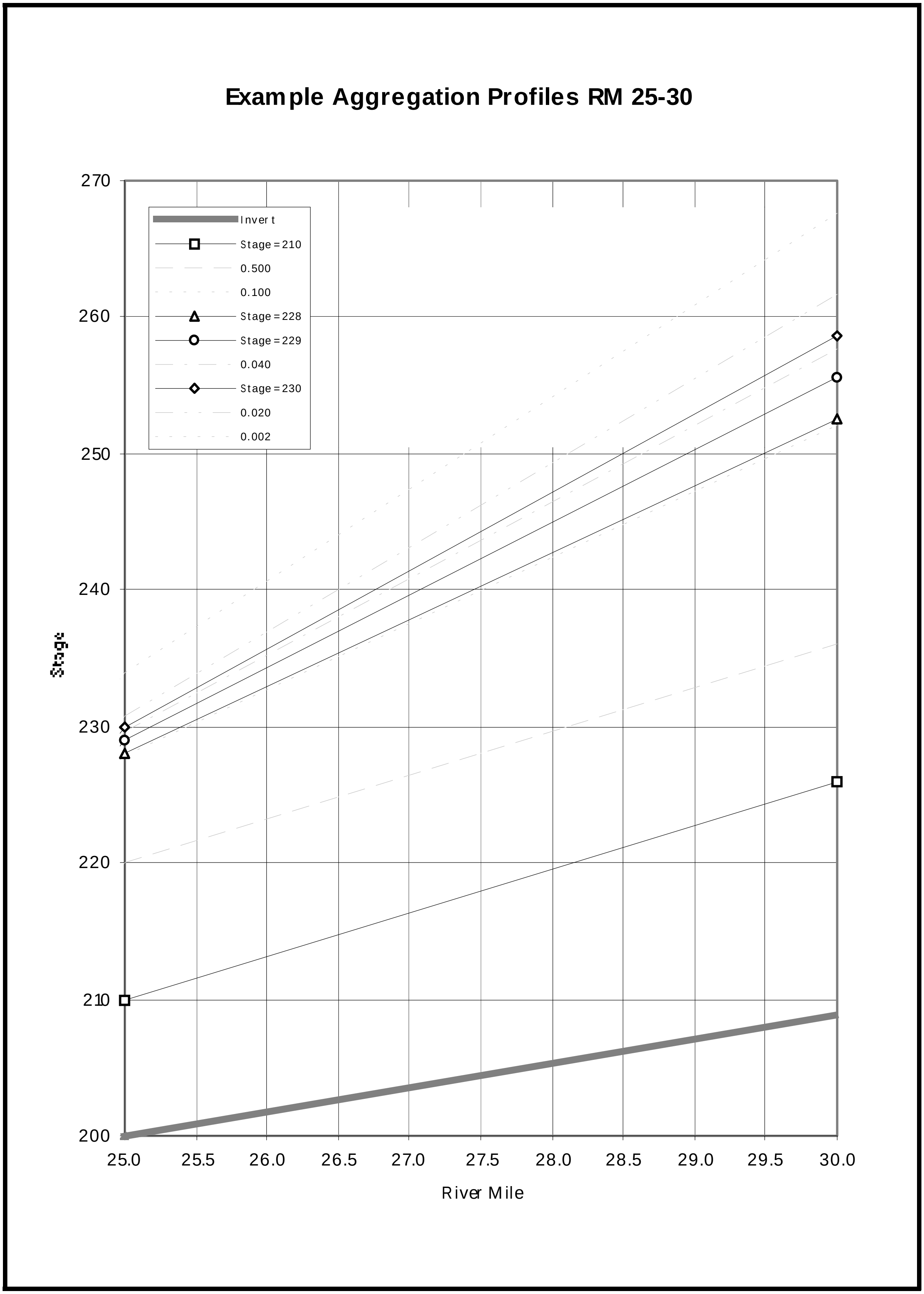

Figure 7 Selected Aggregation and Water Surface Profiles RM 25.000-30.000

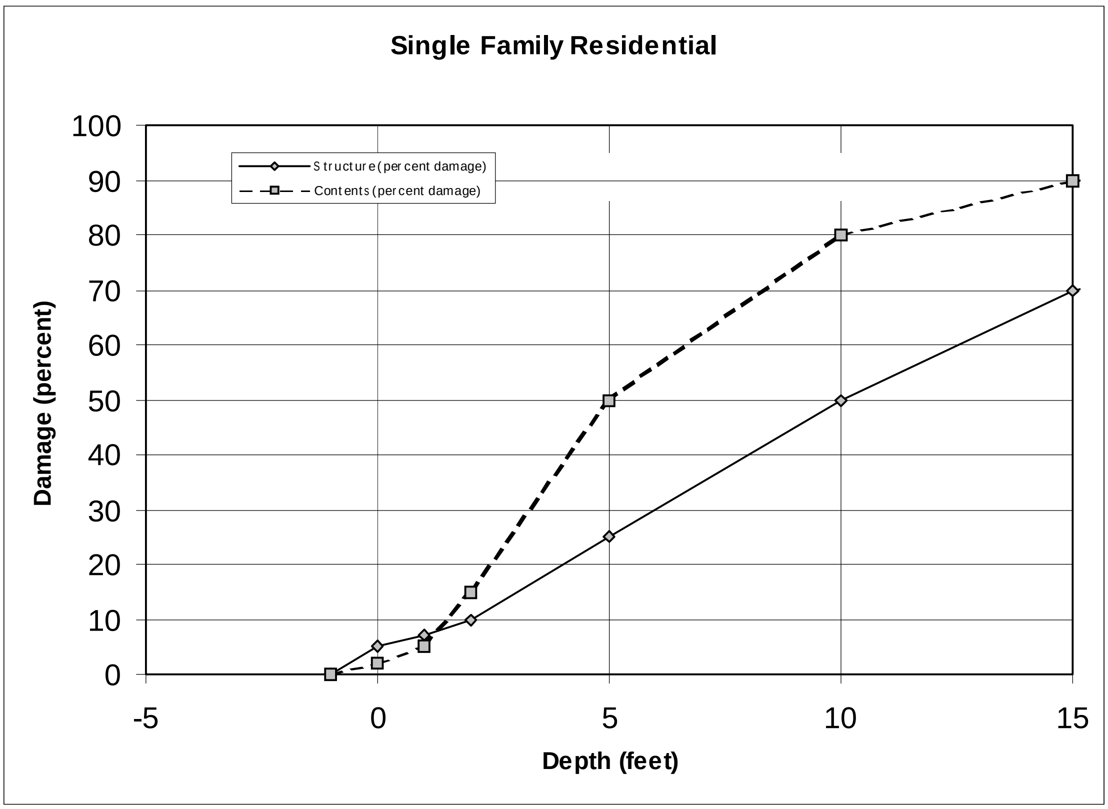

Figure 8 Single Family, Residential, Without Basement Occupancy Type Damage Functions

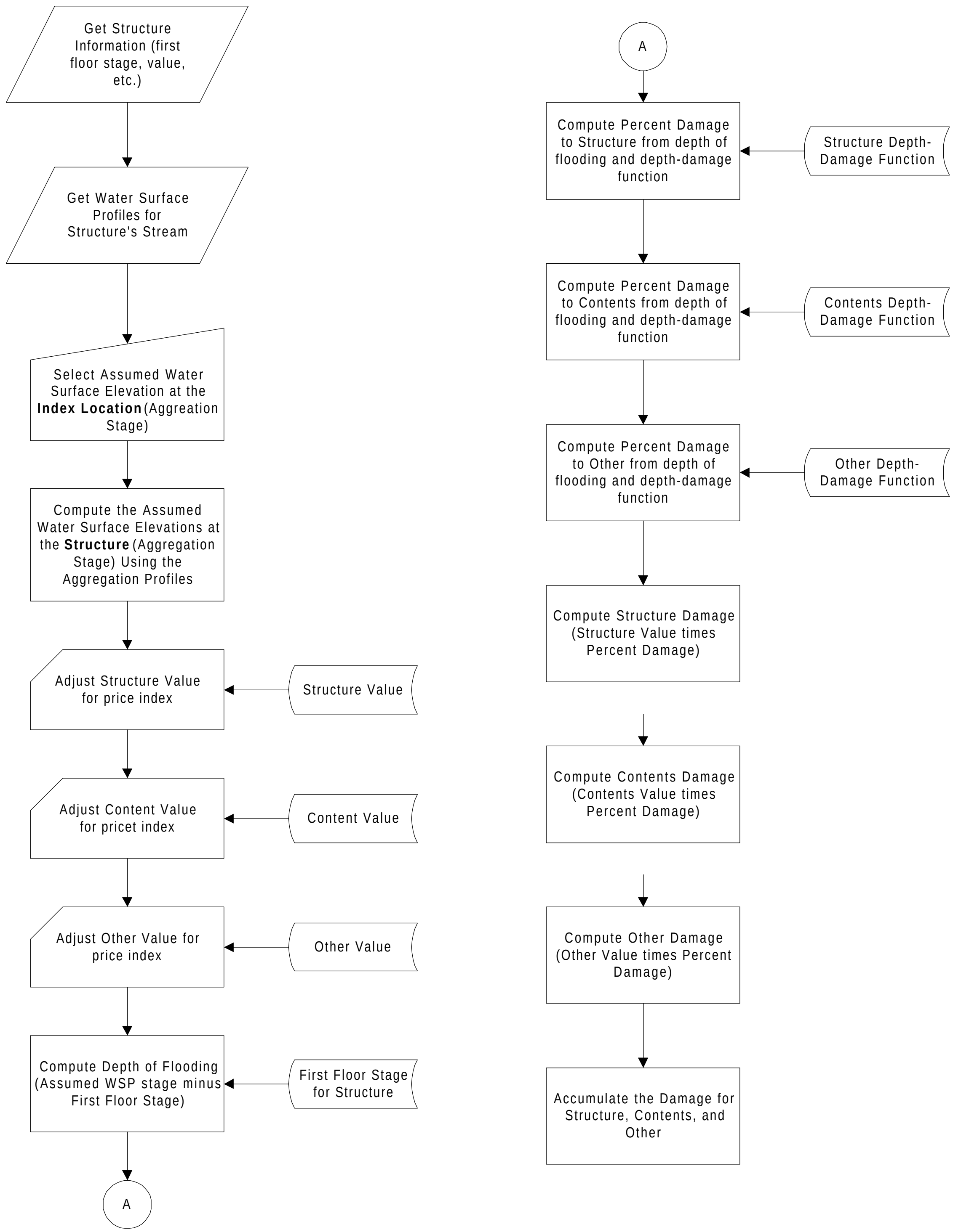

Figure 9 Calculating Stage-Damage Without Uncertainty, One Ordinate

Procedure For Calculating Stage-Damage Without Uncertainty. The following section describes the stage-damage calculations depicted in Figure 9 in more detail. Table 12 lists and Figre 10 graphs results for structure R003. HEC-FDA writes this table to the file "FDA_SDmg.out" if the trace option is set to 10 or greater. In this example, the "mean depth" and the "nominal depth" are the same because there is no uncertainty in the economic functions. Some of the narrative below describes results for the highest aggregation stage. Table 12 lists results for all stages.

(1) Get Structure Information	Retrieve Structure data from the database. Includes first floor stage, value of structure, contents, and other, etc. Table 9 lists some of the sample structure information.
(2) Get water surface profiles for structures stream	Each structure is assigned a stream. The profiles for the current structure are retrieved from the database. For the example, all structures are on "Silver Creek". If profiles do not exist for Silver Creek, the SID reference flood profile may be used. The example structures all use the water surface profiles as list in Table 8.
(3) Select Assumed Water Surface Elevation at the Index Location (Aggregation Stage)	The assumed (or aggregation) stages are listed in Table 10. The index location is at river mile 25.000. The aggregation stages range from 206.0 to 235.0 feet.
(4) Compute the Assumed Water Surface Stage at the Structure using the aggregation profiles	The assumed (or aggregation stages) are calculated at the structure using the profiles listed in Table 8. Table 10 lists the tabulation stages at the index as well as at river mile 20.000 and 30.000 which correspond to structures R001, and R003. For example, an aggregation stage of 235.0 at the index translates into a stage of 268.6 at structure R003. Stages may be interpolated for any river mile between 20.000 and 30.000.
(5) Adjust structure value for price index	The price index is entered as a global value under "File/Study Information". The price index may also be entered by damage category and it will over-ride the global value. If left blank (undefined) the global study price index is used. The price index is simply multiplied by the structure value which is stored in the database to obtain an updated value for calculation purposes. The value in the database is not changed. For this example, the price index is 1.0 and the value for structure R003 is $100k * 1.0 or $100k.

(6) Adjust contents value for price index	Contents value is adjusted in a similar manner to the structure value. The content value must first be determined. For indirect depth-damage functions (using percent damage), it can be computed using the ratio of content-to-structure value entered with the occupancy types. This calculation can be over-ridden by entering a dollar value at individual structures. At the structure level, if the contents value is left blank (undefined), the occupancy code ration is used. For structures having a direct depth-damage function (damage is in thousands of dollars), the content value is not used for calculations since damage is computed directly from the depth-damage function.
(7) Adjust other value for price index	Other value is computed in the same fashion as the contents.
(8) Compute depth of flooding (assumed WSP stage minus first floor stage)	The assumed (aggregation) stages computed above are used to determine the depth of flooding. For the example structure R003, the aggregation stage of 235.0 at the index location translates into a stage of 268.6 at the structure which translates into a depth of 16.6 feet (first floor stage is 252.0 feet).
(9) Compute percent damage to structure from depth of flooding and depth-damage function	The percent structure damage is computed using the depth of flooding (16.6 feet) from step 8 and the depth-percent damage function from occupancy type "SFR Wob". The resulting percent structure damage for a depth of 16.6 feet is 73.2%. HEC-FDA does not extrapolate depth-damage functions for depths beyond the defined depth range.
(10) Compute percent damage to contents from depth of flooding and depth-damage function	The percent contents damage is computed in a manner similar to that for structure damage.
(11) Compute percent damage to other from depth of flooding and depth-damage function	The percent other damage is computed in a manner similar to that for structure damage.
(12) Compute structure damage (structure value times percent damage)	The structure damage is computed using the depth of flooding (16.6 feet) from step 8 and the structure value ($100k) from step 5 and the percent damage (73.2%) for the depth of flooding from occupancy type "SFR Wob" from step 9. The resulting damage is: $100k * 0.732 = $73.2k

(13) Compute contents damage (contents value times percent damage)	The contents damage is computed in a manner similar to that for structure damage.
(14) Compute other damage (other value times percent damage)	The other damage is computed in a manner similar to that for structure damage.
(15) Accumulate the damage for structure, contents and other.	The structure, contents, and other damage is accumulated for the selected stream-reach, and category. When all calculations are complete, the results are stored in the database for the calculation plan and year and are stored separately for each stream-reach, damage category, and type (structure, contents, other, and total).

Table 12 Stage-Damage Without Uncertainty For Structure R003

Structure: R003

Stream: Silver Creek Reach: SC 2R Category: SF Residential

Address: City: State:

Index	WS Elev @ Index	WS Elev @ Structure	Nominal Depth	Mean Depth	Structure Damage	Content Damage	Other Damage	Total Damage
1	206.00	222.00	-30.00	-30.00	$0.00	$0.00	$0.00	$0.00
2	207.00	223.00	-29.00	-29.00	$0.00	$0.00	$0.00	$0.00
3	208.00	224.00	-28.00	-28.00	$0.00	$0.00	$0.00	$0.00
4	209.00	225.00	-27.00	-27.00	$0.00	$0.00	$0.00	$0.00
5	210.00	226.00	-26.00	-26.00	$0.00	$0.00	$0.00	$0.00
6	211.00	227.00	-25.00	-25.00	$0.00	$0.00	$0.00	$0.00
7	212.00	228.00	-24.00	-24.00	$0.00	$0.00	$0.00	$0.00
8	213.00	229.00	-23.00	-23.00	$0.00	$0.00	$0.00	$0.00
9	214.00	230.00	-22.00	-22.00	$0.00	$0.00	$0.00	$0.00
10	215.00	231.00	-21.00	-21.00	$0.00	$0.00	$0.00	$0.00
11	216.00	232.00	-20.00	-20.00	$0.00	$0.00	$0.00	$0.00
12	217.00	233.00	-19.00	-19.00	$0.00	$0.00	$0.00	$0.00
13	218.00	234.00	-18.00	-18.00	$0.00	$0.00	$0.00	$0.00
14	219.00	235.00	-17.00	-17.00	$0.00	$0.00	$0.00	$0.00
15	220.00	236.00	-16.00	-16.00	$0.00	$0.00	$0.00	$0.00
16	221.00	237.82	-14.18	-14.18	$0.00	$0.00	$0.00	$0.00
17	222.00	239.64	-12.36	-12.36	$0.00	$0.00	$0.00	$0.00
18	223.00	241.45	-10.55	-10.55	$0.00	$0.00	$0.00	$0.00
19	224.00	243.27	-8.73	-8.73	$0.00	$0.00	$0.00	$0.00
20	225.00	245.09	-6.91	-6.91	$0.00	$0.00	$0.00	$0.00
21	226.00	247.30	-4.70	-4.70	$0.00	$0.00	$0.00	$0.00
22	227.00	249.91	-2.09	-2.09	$0.00	$0.00	$0.00	$0.00
23	228.00	252.59	0.59	0.59	$6.18	$1.88	$0.00	$8.06
24	229.00	255.54	3.54	3.54	$17.68	$16.46	$0.00	$34.15
25	230.00	258.69	6.69	6.69	$33.45	$30.07	$0.00	$63.53
26	231.00	262.10	10.10	10.10	$50.40	$40.10	$0.00	$90.50
27	232.00	264.60	12.60	12.60	$60.40	$42.60	$0.00	$103.00
28	233.00	266.60	14.60	14.60	$68.40	$44.60	$0.00	$113.00
29	234.00	267.60	15.60	15.60	$71.20	$45.30	$0.00	$116.50
30	235.00	268.60	16.60	16.60	$73.20	$45.80	$0.00	$119.00

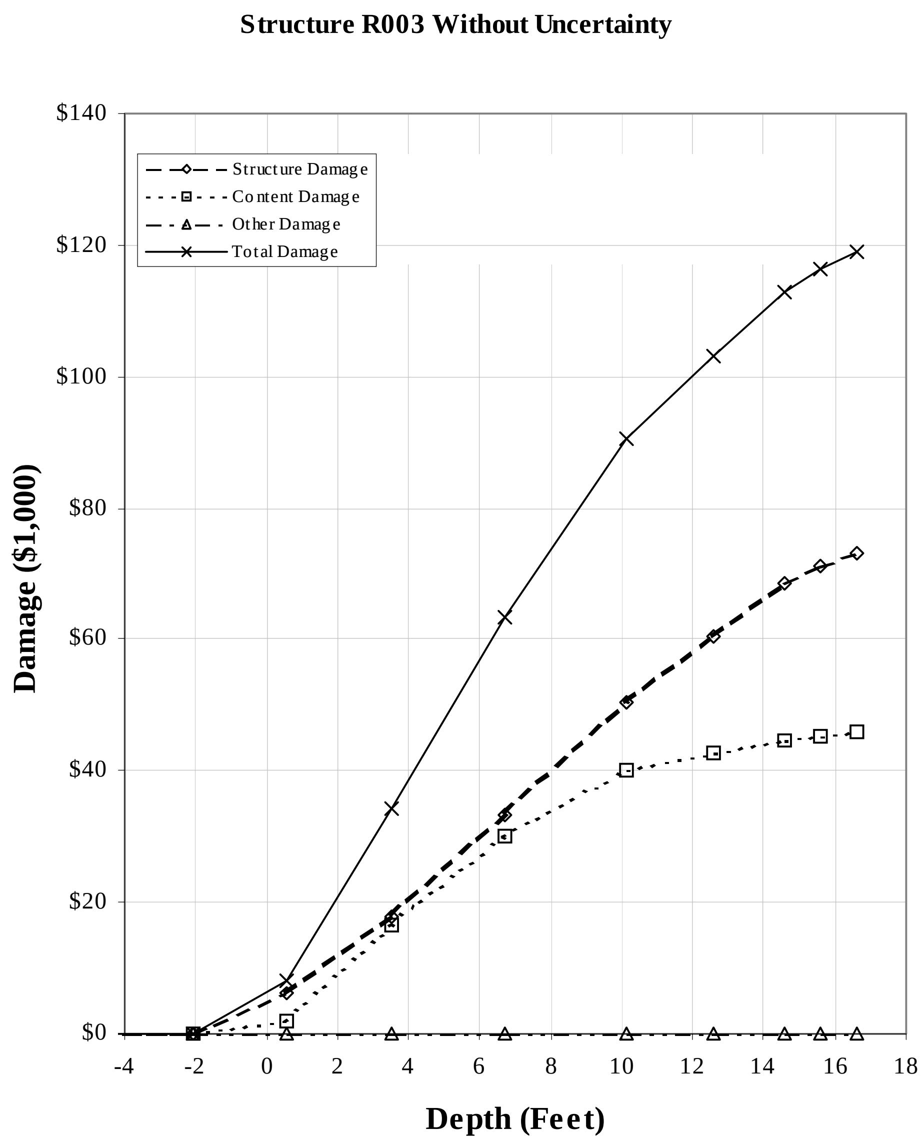

Figure 10 Stage-Damage Without Uncertainty For Structure R003

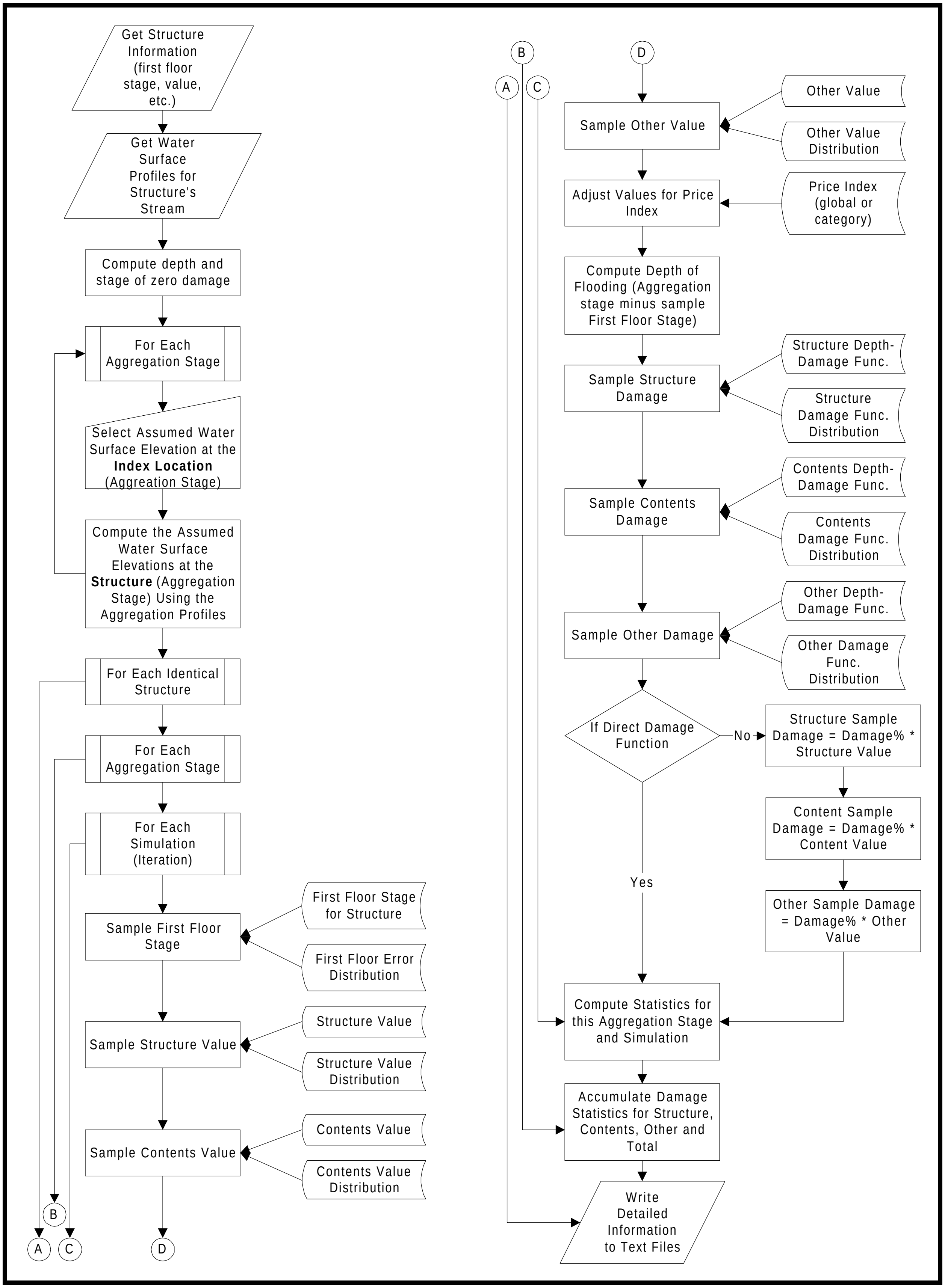

Figure 11 Calculating Stage-Damage With Uncertainty For One Structure

Computing Stage-Damage at One Structure with Uncertainty

Overview. This section describes the calculation of stage-damage for structures whose economic parameters have uncertainty. The calculations are similar to those when there is no uncertainty except that one or more parameters or functions are sampled. When there is no uncertainty, calculations are done only once for each assumed (aggregation) stage. When uncertainty is included, the calculations must be performed repetitively for each assumed water surface stage (and associated depth of flooding). Figure 11 depicts the calculation procedures for one structure with uncertainty. Although similar to Figure 9, Figure 11 not only reflects risk-based computations but also depicts the calculation loop for all aggregation ordinates as well as multiple iterations when a single structure record represents multiple, identical structures.

Risk-Based Calculations. The repetitive risk-based calculations are done within the simulation loop. HEC-FDA makes 100 simulations at each stage but you can change this using the Compute Stage-Damage options. You may specify uncertainty parameters for the first floor stage, structure value, content value, other value, and damage in the depth-damage function. Each of the uncertainties are defined by one or more parameters and an associated distribution. Allowable distributions include normal, log-normal, triangular, and uniform. For example, to describe the uncertainty in the first floor stage, the analyst may define a normal distribution with a standard deviation of 0.3 feet. For each simulation, HEC-FDA samples this first floor distribution to derive a simulated first floor stage with error. Similar procedures are used for values (structure, content, other) and the damage in the depth-damage functions.

Identical Structures. The calculation loop for identical structures allows the analyst to enter data for one structure but can specify that it represents several structures which have identical characteristics (first floor stage, value, occupancy type, etc.). You enter an integer which is greater than one for **Number of Structures** which is located in the GUI under **Economics/ Optional Information**. HEC-FDA takes one structure record and iterates the calculation loop “Number of Structures” times. Each iteration is treated as a new structure with full Monte-Carlo simulation but uses the same basic structure information such as first floor stage, structure value, occupancy type, etc.

Detailed Description of Stage-Damage Calculation With Uncertainty. The following section describes in detail the stage-damage calculations depicted in Figure 11. It is similar to the previous section on calculations without uncertainty. Table 13 lists the uncertainty parameters for this example. Table 14 lists results for structure R003. HEC-FDA writes this table to the file “FDA_SDmg.out” if the trace option is set to 10 or greater. The trace level is set from the menu item **Options/Compute Options** which is located on the **Economics/Compute Reach Stage-Damage With Uncertainty** screen. In this example, the mean depth and the nominal depth are not the same because there is uncertainty in the economic functions. The nominal depth is the depth when no uncertainty is used whereas the mean depth is the calculated mean depth after Monte-Carlo simulations. Some of the narrative below describes results for the highest aggregation stage. Figure 12 depicts the stage-damage with uncertainty function for structure R003.

Table 13 Uncertainty Parameters For Example Problem

Parameter	Distribution	Std. Dev
First Floor Stage	Normal	0.3 feet
Structure Value	Normal	10%
Contents Value Ratio	Normal	20%
Damage in Depth-Damage Function	Normal	5%

(1) Get Structure Information	Retrieve Structure data from the database. Includes first floor stage, value of structure, contents, and other, etc. Table 9 lists some of the sample structure information.
(2) Get water surface profiles for structures stream	Each structure is assigned a stream. The profiles for the current structure are retrieved from the database. For the example, all structures are on “Silver Creek”. If profiles do not exist for Silver Creek, the SID reference flood profile may be used. The example structures all use the water surface profiles as list in Table 8.
(3) Compute depth and stage of zero damage	HEC-FDA looks at the depth-damage functions (structure, content, and other) and the optional “Beginning Damage Depth” to determine the highest depth of zero damage. For the example occupancy code, this is at a depth of -1 feet. Normally, the “Beginning Damage Depth” is left blank (undefined). It may be defined by individual structure if the damage functions are truncated at some depth. For example, this typically occurs for houses with basements where the damage function may start at a depth of -8 feet but water may not enter the basement until it reaches a depth of -1 foot. If some barrier prevented water from reaching structure R003 before a depth of 1 foot, then the analyst would define the “Beginning Damage Depth” as 1.0 foot and HEC-FDA would set the damage to zero for all aggregation depths of 1 foot or less during the Monte-Carlo simulations. The corresponding stage of zero damage is computed during the simulations as the sum of the first floor stage with error and the “Beginning Damage Depth”.

(4) Select Assumed Water Surface Elevation at the Index Location (Aggregation Stage)	The assumed (or aggregation) stages are listed in Table 10. The index location is at river mile 25.000. The aggregation stages range from 206.0 to 235.0 feet.
(5) Compute the Assumed Water Surface Stage at the Structure using the aggregation profiles	The assumed (or aggregation stages) are calculated at the structure using the profiles listed in Table 8. Table 10 lists the tabulation stages at the index as well as at river mile 20.000 and 30.000 which correspond to structures R001, and R003. For example, an aggregation stage of 235.0 at the index translates into a stage of 268.6 at structure R003. Stages may be interpolated for any river mile between 20.000 and 30.000.
(6) For Each Identical Structure, Process the following steps	Normally, the subsequent steps are processed once. If the “Number of Structures” is set to a value greater than 1, the current structure is processed “Number of Structures” times to facilitate a crude sampling of structures. For example, if processed 10 times, it is equivalent to entering 10 identical structures.
(7) For Each Aggregation Stage	The following steps are repeated for each assumed (aggregation) stage. The stages are listed in Table 10.
(8) For Each Simulation (Iteration)	The following steps are repeated for each Monte-Carlo simulation. HEC-FDA currently does 100 simulations. The analyst can set this to some other number under the menu item **Options/Compute Options** in the screen **Economics/Compute Stage-Damage With Uncertainty**.
(9) Sample First Floor Stage	The first floor stage with uncertainty is computed from the first floor stage, the uncertainty distribution and the uncertainty parameters. The uncertainty data is defined with the occupancy types (indirect depth-percent damage functions) or the structure (direct depth-dollar damage functions). The uncertainty parameters are in the same units as the first floor stage. For structure R003 (first floor stage of 252.0), the uncertainty in the first floor stage is modeled using the normal distribution with a standard deviation of 0.3 feet. If a sampled error in the first floor stage was one standard deviation from the median, the sampled first floor stage would be 252.3 feet.

(10) Sample Structure Value	The structure value with uncertainty is computed from the structure value, the uncertainty distribution, and the uncertainty parameters. The uncertainty data is defined with the occupancy types. If using direct depth-dollar damage functions, the structure value is not sampled because it is built into the uncertainty of the damage function. The uncertainty parameters are entered in the percent of structure value. Table 13 lists the uncertainty parameters for the example data. For structure R003 (value $100,000; occupancy code structure value error of 10%) a simulation error of one standard deviation would result in a sample structure value of $110,000 ($100,000 * 10% * 1stddev). The use of uncertainty in percent allows structures of different values to use the same occupancy type and still maintain reasonable errors about the median value. For example, a $200,000 house using the same example occupancy type would have a computed standard deviation of error of $20,000.
(11) Sample Contents Value	Contents value is sampled in a similar manner to the structure value. The content value must first be determined. For indirect depth-damage functions (using percent damage), it can be computed using the ratio of content-to-structure value entered with the occupancy types. This calculation can be over-ridden by entering a dollar value at individual structures. At the structure level, if the contents value is left blank (undefined), the occupancy code ratio is used to compute contents value from the structure value. If using direct depth-dollar damage functions, the contents value is not sampled because it is built into the uncertainty of the damage function. The uncertainty parameters are entered in the percent of contents value ratio or value. The occupancy code for this example has a ratio of 50% for contents-to-structure value ratio. For structure R003 (contents value = $50,000 = $100,000 times 50%; occupancy code has a contents value ratio error of 20%) a simulation error of one standard deviation would result in a sample contents value of $60,000 (error = $100,000 * 50% * 20% * 1stddev). The use of uncertainty in percent allows structures of different content values to use the same occupancy type and still maintain reasonable errors about the median value. For example, a $200,000 house using the same example occupancy type would have a computed standard deviation of error of $20,000.

(12) Sample Other Value	Other value is sampled in the same fashion as the contents.
(13) Adjust Values for Price Index	The price index is entered as a global value under **File /Study Information**. The price index may also be entered by damage category and it will over-ride the global value. If left blank (undefined) the global study price index is used. The price index is simply multiplied by the structure, contents, and other values to obtain an updated values for calculation purposes. The values in the database are not changed. For this example, the price index is 1.0 and the value for structure R003 is $100k * 1.0 or $100k (no error in structure value). During Monte-Carlo simulation, the price index is multiplied by the values with sampling error.
(14) Compute depth of flooding (Aggregation stage minus sample first floor stage)	The assumed (aggregation) stages computed above and the sampled first floor stage are used to determine the depth of flooding. For the example structure R003, the aggregation stage of 235.0 at the index location translates into a stage of 268.6 at the structure. If the sampled first floor stage is 252.3, the depth of flooding is 16.3 feet (first floor stage without error is 252.0 feet and with a one standard deviation of error is 252.3 feet).

(15) Sample Structure Damage	The sampled structure damage is computed from the sampled depth of flooding, and the sampled depth-damage function. The sampled percent structure damage is computed using the depth of flooding (16.3 feet) from step 14 and the depth-percent damage function with uncertainty from occupancy type "SFR Wob". The resulting percent structure damage for a sampled depth of 16.3 feet is 72.6% (unsampled damage function) or 76.2% (sampled, one standard deviation away from the median damage). HEC-FDA does not extrapolate depth-damage functions for depths beyond the defined depth range. For this example of structure R003 using the sampled first floor stage (252.3), the sampled structure value ($110,000), and the sampled depth-percent damage function (76.2% damage), the structure damage is computed as: $110,000 * 76.2 = $83,820 This can be compared to the same calculation of structure damage without uncertainty which was $73,200. Obviously, it is very rare that the sampled parameters would always be +1 standard deviation away from the median. The procedure for sampling structures using direct depth-dollar damage functions is the same as for with indirect depth-damage functions with the exception that damage is computed directly from sampled depth and sampled direct depth-damage functions.
(16) Sample Contents Damage	The sampled contents damage is computed in a manner similar to that for structure damage.
(17) Sample Other Damage	The sampled other damage is computed in a manner similar to that for structure damage.
(18) Compute Statistics for this Aggregation Stage and Simulation	The statistics for the current aggregation stage for all simulations are computed and stored in memory before the aggregation stage is decreased for the next simulations.
(19) Accumulate the damage for Structure, Contents and Other.	The structure, contents, and other damage is accumulated in memory for the selected stream-reach, and category.

(20) Write Detailed Information to Text Files	When all simulations are completed for the current structure, HEC-FDA accumulates the current results in memory and writes various levels of calculation results to text files "FDA_SDmg.out" (stage-depth-damage by structure and by reach-category), "FDA_StrucDetail.out" (individual structure results in a tab-delimited text file suitable for import to a spreadsheet), and "FDA_SDev.out" (individual structure Monte-Carlo simulation results).
(21) Store Results in the Database	When all calculations are complete, the results are stored in the database for the calculation plan and year and are stored separately for each stream-reach, damage category, and type (structure, contents, other, and total). The EAD calculations utilize only the total damage for each category - not the individual structure, contents and other damage.

Table 14 Stage-Damage With Uncertainty For Structure R003

Structure: R003								
Stream: Silver Creek	Reach: SC 2R	Category: SF Residential						
Address:	City:	State:						
	WS Elev @ Index	WS Elev @ Structure	Nominal Depth	Mean Depth	Structure Damage	Content Damage	Other Damage	Total Damage
1	206.00	222.00	-30.00	-30.00	$0.00	$0.00	$0.00	$0.00
2	207.00	223.00	-29.00	-29.00	$0.00	$0.00	$0.00	$0.00
3	208.00	224.00	-28.00	-28.00	$0.00	$0.00	$0.00	$0.00
4	209.00	225.00	-27.00	-27.00	$0.00	$0.00	$0.00	$0.00
5	210.00	226.00	-26.00	-26.00	$0.00	$0.00	$0.00	$0.00
6	211.00	227.00	-25.00	-25.00	$0.00	$0.00	$0.00	$0.00
7	212.00	228.00	-24.00	-24.00	$0.00	$0.00	$0.00	$0.00
8	213.00	229.00	-23.00	-23.00	$0.00	$0.00	$0.00	$0.00
9	214.00	230.00	-22.00	-22.00	$0.00	$0.00	$0.00	$0.00
10	215.00	231.00	-21.00	-21.00	$0.00	$0.00	$0.00	$0.00
11	216.00	232.00	-20.00	-20.00	$0.00	$0.00	$0.00	$0.00
12	217.00	233.00	-19.00	-19.00	$0.00	$0.00	$0.00	$0.00
13	218.00	234.00	-18.00	-18.00	$0.00	$0.00	$0.00	$0.00
14	219.00	235.00	-17.00	-17.00	$0.00	$0.00	$0.00	$0.00
15	220.00	236.00	-16.00	-16.00	$0.00	$0.00	$0.00	$0.00
16	221.00	237.82	-14.18	-14.18	$0.00	$0.00	$0.00	$0.00
17	222.00	239.64	-12.36	-12.36	$0.00	$0.00	$0.00	$0.00
18	223.00	241.45	-10.55	-10.55	$0.00	$0.00	$0.00	$0.00
19	224.00	243.27	-8.73	-8.73	$0.00	$0.00	$0.00	$0.00
20	225.00	245.09	-6.91	-6.94	$0.00	$0.00	$0.00	$0.00
21	226.00	247.30	-4.70	-4.73	$0.00	$0.00	$0.00	$0.00
22	227.00	249.91	-2.09	-2.12	$0.00	$0.00	$0.00	$0.00
23	228.00	252.59	0.59	0.61	$6.19	$0.79	$0.00	$6.98
24	229.00	255.54	3.54	3.56	$17.73	$6.64	$0.00	$24.37
25	230.00	258.69	6.69	6.71	$33.47	$12.06	$0.00	$45.53
26	231.00	262.10	10.10	10.12	$50.30	$16.01	$0.00	$66.31
27	232.00	264.60	12.60	12.62	$60.35	$17.06	$0.00	$77.41
28	233.00	266.60	14.60	14.62	$68.31	$17.86	$0.00	$86.17
29	234.00	267.60	15.60	15.62	$71.09	$18.14	$0.00	$89.23
30	235.00	268.60	16.60	16.62	$73.09	$18.34	$0.00	$91.43

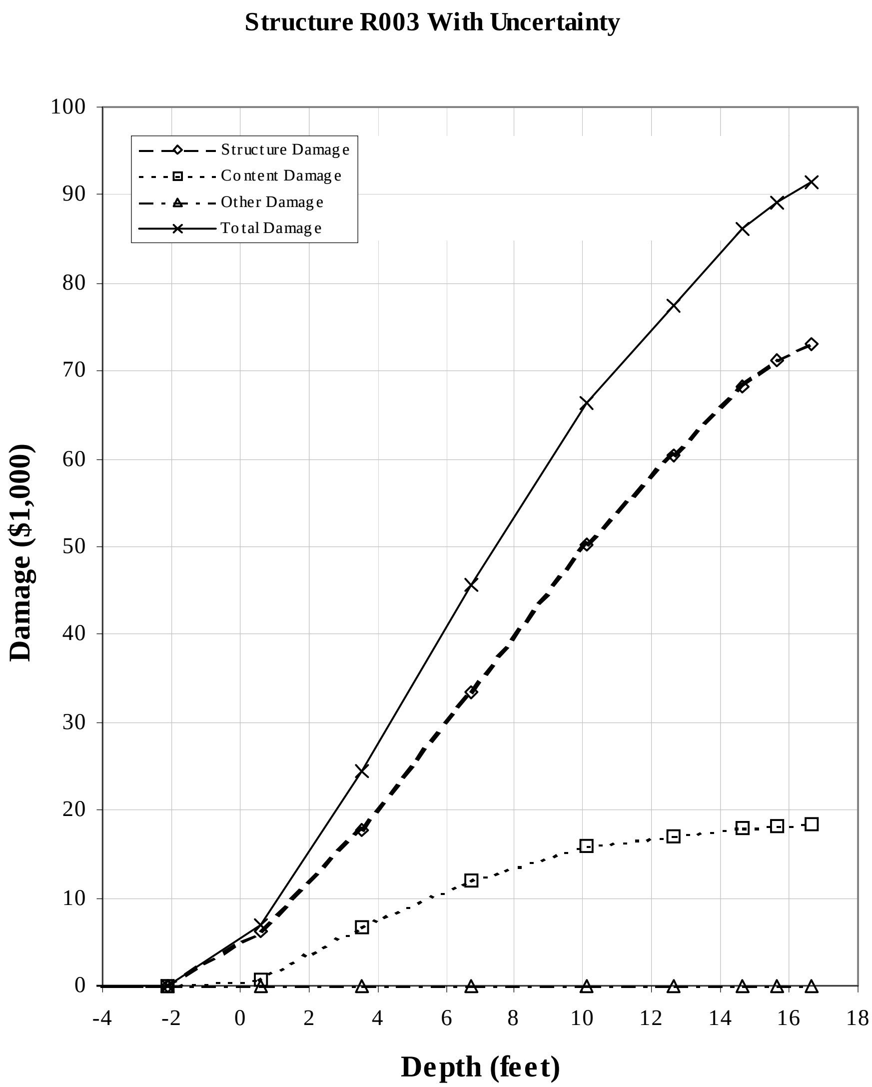

Figure 12 Stage-Damage With Uncertainty For Structure R003

Aggregating the Stage-Damage Functions To the Index Location

The process of using either the eight water surface profiles or the SID reference flood water surface profile has been described earlier. Since the calculations are done at each structure at the aggregation stages, the results (both damage as well as statistics for uncertainty calculations) are easily accumulated to the index location. Table 15 displays the total simulated damage for reach SC 2R. It includes aggregated damage for the three residential structures. Damage categories Commercial, Industrial, and Public do not have damage since only residential structures have been entered in this reach.

Table 15 Total Stage-Aggregated Damage, Reach SC 2R

Total Aggregated Damage Matrix.					
Stream: Silver Creek	Reach: SC 2R				
	Stage	Commercial	Industrial	Public	SF Residen
1	206	0	0	0	0
2	207	0	0	0	0
3	208	0	0	0	0
4	209	0	0	0	0
5	210	0	0	0	0
6	211	0	0	0	0
7	212	0	0	0	0
8	213	0	0	0	0
9	214	0	0	0	0
10	215	0	0	0	0
11	216	0	0	0	0
12	217	0	0	0	0
13	218	0	0	0	0
14	219	0	0	0	0
15	220	0	0	0	0
16	221	0	0	0	0
17	222	0	0	0	0
18	223	0	0	0	0
19	224	0	0	0	0
20	225	0	0	0	0
21	226	0	0	0	0
22	227	0	0	0	1.41
23	228	0	0	0	12.83
24	229	0	0	0	33.53
25	230	0	0	0	60.21
26	231	0	0	0	90.12
27	232	0	0	0	111.77
28	233	0	0	0	128.86
29	234	0	0	0	138.73
30	235	0	0	0	151.23

Considerations in Defining Economic Data

Defining Damage Reaches

Damage reaches should be defined for the following:

(1) To provide sufficient detail in the results, and

(2) To facilitate the analysis of levees.

Although there is no limit to the number of damage reaches, the required calculation time is directly proportional to the number of reaches so it behooves you to define the minimal number that is sufficient. A reach containing a levee cannot contain structures that are unprotected by the levee. This may require the analyst to define more reaches that what they would otherwise define.

Reaches may be defined using one of two methodologies:

(1) Calculated using the structures stream name, station, and bank, and
(2) Explicitly defined using the SID Reach Name (and stream name).

The calculation works well if the reaches do not overlap from a stream stationing standpoint. However, this is sometimes impossible. For example, levee plans may describe several alignments with different setbacks from the stream. You may wish to define two reaches on one bank of the stream - one reach containing protected and one reach containing unprotected structures. This example actually contains two problems:

(1) The reaches overlap, and
(2) The geographic area changes with the plans as a function of the levee alignment.

The use of Structure Modules can address the problem of the changing geographic area. The problem of mixed levee protection can be addressed by either:

(1) The use of stream bank location,
(2) The use of SID Reach Names, or
(3) The addition of pseudo streams.

If the levee is proposed for only one side of the stream, the protected structures are entered as if they are located on one bank whereas the unprotected structures are entered as if located on the other bank. The disadvantage of this method is that the structure's bank location is defined based upon levee protection rather than on physical location. If levees of different heights are proposed for each side of the stream, this methodology will not work. The use of pseudo streams requires the duplication of hydraulic and hydrologic engineering data. The use of SID Reach Names requires the definition of the reach name for each structure which can be tedious but allows the proper definition of stream bank, does not require the duplication of hydrologic engineering data, and facilitates the overlap of two or more reaches. The stream stations and water surface profiles (or alternatively, the SID reference flood water surface profile) are still used to aggregate damage to the index location.

Defining Damage Categories

You should define enough damage categories to facilitate detailed reporting. There is no limit to the number of categories and there is a minimal increase in computational time for additional categories. The number of categories should be sufficient to give enough detail but not too numerous to complicate data management.

HEC-FDA calculates stage-damage on a structure-by-structure basis, aggregating the results for each structure to the index location. The stage-damage calculation for some categories of damage (emergency costs, road damage, automobile damage) normally do not use structure inventory techniques. However, to include these categories in the risk-based analysis, you may calculate the stage-aggregated damage with uncertainty outside of HEC-FDA and enter the resulting stage-damage as a “direct depth-dollar damage” function for a single hypothetical structure. Typically, a pseudo structure is entered at the index location with either a pseudo first floor stage or a first floor stage set to zero. The depth-dollar damage function may be entered either using the normal depth-damage function or a stage-damage function. If stages are used, then the first floor stage is entered as zero (not blank)

Occupancy Types (Depth-Damage Functions)

Occupancy types are defined by damage category, and the same occupancy type cannot be used for different categories. Occupancy types contain depth-damage functions where damage is defined in percent of value (structure, content, and other). Structures which have a direct depth-dollar damage function assigned to them have a somewhat hidden occupancy type with an HEC-FDA internally generated name. You will not normally see the direct damage function occupancy types except in the “List of Occupancy Types” table. Although user-defined occupancy types can apply to one structure, they normally represent a large class of structures (such as one story, single family residential, wood frame construction, no basement).

Structure Modules

Structure Modules allow you to modify the attributes of a structure as a function of Plan and Year. This facilitates several needs including assigning a structure to a different reach as a function of plan, or analyzing alternative future development. Structures must have a unique name. If the same structure is entered in more than one module (such as module “A” and module “B), the structure must have a different name. For example, the structure named 235 might be given the name “235A” in module A and “235B” in module B. When using the modules for a given plan/year combination, either module “A” or module “B” are used, not both or the structure would be used twice.

Compute Options for Stage-Damage With Uncertainty Computations

Introduction to Options

You may control several options for the **Compute Reach Stage-Damage with Uncertainty** function under the **Economics** main menu. There are two types of options:

(1) Options that can vary by plan and year, and

(2) Options that apply globally to all plans and years.

The analyst must exercise caution when changing options between computations. Hec-fda will not mark results as invalid when calculation options are changed. Some of the options control calculations (e.g., the number of simulations, the use of risk analysis, etc.) And some control the output (e.g., detailed stage-damage and Monte-Carlo simulation output by structure, etc.). If an output option is changed, there is no effect on the results but if stage damage is calculated, the expected annual damage results are marked as invalid.

Description of Output Files

Several output files are generated by HEC-FDA. Some are generated only if requested by the user. The results and diagnostic information are written to the following output files:

- “FDA_SDmg.out” Contains stage-damage functions by reach and category and optionally by structure. This is often referred to as the “Trace Output” file.

- “FDA_SdErrors.out” Contains structure data validation information. It lists optionally each structure and also summary information. The output and indicates invalid data (such as unknown reach, damage category, etc.) as well as structures that were not included in the calculations (structure is out of the flood plain, was placed in service after the current year). It is a tab-delimited text file suitable for easy import into a spreadsheet.

- “FDA_StrucDetail.out” contains detailed structure information including all of the structure’s data (first floor stage, structure value, etc.) as well as damage computed for each of the water surface profile frequencies. The damage is computed without uncertainty and does not reflect damage reduction due to levees which is computed during the expected annual damage simulation. This is often referred to as the “Structural Details” file. It is a tab-delimited text file suitable for easy import into a spreadsheet. It contains one row of headings that correspond to the “Import ASCII Tab-Delimited Text File” column headings and provides a means of exporting structure data from the database. The analyst may then import the data into a spreadsheet, edit the data, export it to a tab-delimited text file, and then import it back into the HEC-FDA database.

- “FDA_SDev.out” contains detailed results by structure of the Monte-Carlo simulations for stage-damage. This is often referred to as the “Standard Deviation Trace” file.

Options Set for Plan/Year

The options that vary by plan and year are set in the **Compute Reach Stage-Damage Function with Uncertainty** screen which is located under the main menu **Economics**. The options that may be set are:

- Compute With Risk. If checked, HEC-FDA will use all uncertainties in values (structure, content, other), first floor stage, and depth-damage functions to compute stage-damage. If left unchecked, the stage-damage is computed without using any of the uncertainties. Computing without uncertainties reduces computational time and is useful when first analyzing the data.

- Use SID Reaches. If checked, HEC-FDA will use the SID reach name to determine the reach to which the current structure’s stage-damage function is aggregated. If left unchecked, HEC-FDA computes the reach based upon the structure’s stream name, station, and bank and the reach definitions. As mentioned earlier, if insufficient data is available to determine the reach from the selected option, HEC-FDA tries to determine the reach from the alternative option.

- Use SID Reference Flood. If checked, HEC-FDA uses the SID reference flood water surface profile to aggregate individual structure stage-damage functions to the index location. If left unchecked, HEC-FDA uses the eight water surface profiles to aggregate individual structure stage-damage to the index location. As mentioned earlier, if insufficient data is available to aggregate stage-damage using the selected option, HEC-FDA tries to aggregate using the alternative option.

Options Set Globally

The global options are set in the **Compute Options** screen which is located under the main menu **Economics/Compute Reach Stage-Damage Function with Uncertainty/Options**. The following list includes the HEC-FDA screen name and the default value in parentheses. The options that may be set are:

- **Number of Monte-Carlo Simulations (100)**. The number of Monte-Carlo Simulations at each stage ordinate in the stage-damage Function.

- **Minimum Number of Intervals (20)** and **Max Number of Intervals (30)**. The range in the number of ordinates in the stage-aggregated Damage function. The program will determine the actual number by determining a stage increment between ordinates that is one of the numbers 1, 2, or 5 times some power of ten. For example, it may pick an increment of 1, 2, 5, 10, or 20 feet between ordinates, but not 3, 4, 6, 8, 11, etc. feet. The range of stages is computed from the mean discharge-exceedance probability and rating curves. If they are not entered, the stages are computed from the water surface profiles. If none of that information is available, HEC-FDA cannot determine the stages and cannot compute stage-aggregated damage. The maximum number of stage ordinates is 60.

- **TraceLevel (1)**. Controls the amount of output written to the files "FDA_SDmg.out", "FDA_SdErrors.out", and "FDA_SDev.out" when stage-aggregated damage is computed.

  Output written to the file "FDA_SDmg.out" includes information about the Date/Time of calculation, study name, description, the subdirectory in which the data is stored, the plan/year of calculations. It also details the calculation of the range and increment of stages for the stage-aggregated damage matrix for each reach. Additional detailed information about each structure is written if the trace level is high enough. All output is cumulative with the trace level - if it is written at TraceLevel = 1, then it is written at trace level 5.

  Output written to the file "FDA_SdErrors.out" includes errors in processing structure information (like cannot determine the reach, there is no occupancy type, etc.).

  Output written to "FDA_SDev.out" is related strictly to the Monte-Carlo simulation. TraceLevel must be greater than 49 to write any information to this file.

TraceLevel	Description
0	No output is written
>0	All information about the study, plan, year, data validation, confirmation line for each structure, and stage-aggregated damage functions is written. The damage functions include structure, contents, other, and total for all streams and reaches. The functions include a stage-aggregated damage for all categories as well as individual functions for each category and component (structure, content,...) with associated standard deviation of the error in the damage. Summary data validation information is written to file “FDA_SdErrors.out”.
>4	Basic structure information including structure name, address, etc. is written.
>9	Tabulation of stage-aggregated damage for each structure is written. It includes structure, content, other, and total.
>49	Detailed table of Monte-Carlo simulation results for each structure is written to "FDA_SDev.out". Detailed data validation for each structure is written to “FDA_SdErrors.out”.
>99	Internal debug stuff that is not related to the computations.

- Write Structural Details (yes). Controls the output of detailed structure information. If unchecked, HEC-FDA will not write detailed information for each structure to the file "FDA_StrucDetail.out". If checked, HEC-FDA writes detailed structure information to file "FDA_StrucDetail.out". One row is written for each structure in tab-delimited text format. It includes all structure attributes entered by you as well as stage, depth, damage at each of the computed water surface profile stages.

- Append Trace (no). If unchecked, HEC-FDA will overwrite any existing output written to the files “FDA_SDmg.out” and “FDA_SdErrors.out”. If checked, output will be appended to existing information.

- Append Std Dev Trace (no). If unchecked, HEC-FDA will overwrite any existing output written to the file “FDA_SDev.out”. If checked, output will be appended to existing information.

- Append Structural Details (no). If unchecked, HEC-FDA will overwrite any existing output written to the file "FDA_StrucDetail.out". If checked, output will be appended to the existing information.

- Import Field Separator(s) (Tab, Other Character = *). Defines characters which are used to parse fields in delimited text files which are imported into the HEC-FDA database. The "Tab" character is the preferred option and must be used for importing "tab-delimited" text files such as ASCII structure inventory files created in a spreadsheet.

Example Output to Text Files

This section contains example output which is written to the text files which are described above. It is a fairly comprehensive example of the level and type of output for given values of "TraceLevel".

Basic Output, TraceLevel > 0, File FDA_SDmg.out and FDA_SdErrors.out

For a "TraceLevel" of one or greater, HEC-FDA will produce the following output. The following illustrates the trace output which includes stage-damage by category as well as with the uncertainty parameters by category, reach, and component (structure, content, other, and total). For every reach, the first table lists stage-aggregated damage for each category but does not include the computed standard deviation of error in damage. The subsequent tables list stage-aggregated damage by each component (structure, content, other), damage category, and reach. These tables include the computed standard deviation of error in damage.

Summary Output for each Plan/Year/Stream/Reach/Category, File "FDA_SDmg.out"

The first output in file "FDA_SDmg.out" includes information about the date and time of computations, the Study name and description, the subdirectory in which the study resides, and the plan/year for which calculations are displayed.

The next table is a matrix of stage-aggregated damage by category. All categories are listed. There are four tables which correspond to the following components of damage calculations: (1) Structure, (2) Contents, (3) Other, and (4) Total.

```
================================================================================
File D:\data\FDA\NewDataBase\BearTrng\FDA_SDmg.out opened on Mon Dec 01 15:54:27 1997

Study:        Beargrass Creek
Description:  S. Fork Beargrass & Buechel Branch
Pathname:     D:\data\FDA\NewDataBase\BearTrng
Plan:         Without
Year:         1995


Determine Scaling for all reaches Using Frequency & Rating Functions.
------------------------------------------------------------
Stream           Reach           Total of 4 reaches.

Buechel Branch   BB-4
  Scaling (obsmin, obsmax, nuRange):           491.92          495.94     20-30
  Output num, min, max, intrvl   22     min     491.80     max     496.00     intrvl       0.20

Buechel Branch   BB-5
  Scaling (obsmin, obsmax, nuRange):           497.63          502.51     20-30
  Output num, min, max, intrvl   26     min     497.60     max     502.60     intrvl       0.20

S Fork Beargrass SF-8
  Scaling (obsmin, obsmax, nuRange):           468.25          476.76     20-30
  Output num, min, max, intrvl   20     min     468.00     max     477.50     intrvl       0.50

S Fork Beargrass SF-9
  Scaling (obsmin, obsmax, nuRange):           476.86          484.19     20-30
  Output num, min, max, intrvl   20     min     476.50     max     486.00     intrvl       0.50


Structure Aggregated Damage Matrix.
Stream: Buechel Branch       Reach: BB-4
        Stage       APT      AUTO      COMM       PUB       RES
--- --------- --------- --------- --------- --------- ---------
  1    491.80    282.69      0.00      0.00      0.00      0.00
  2    492.00    282.69      0.00      0.00      0.00      0.00
  3    492.20    282.69      0.00      0.00      0.00      0.00
  4    492.40    282.69      0.00      0.00      0.00      0.00
  5    492.60    283.56      0.00      0.00      0.00      0.00
  6    492.80    290.89      0.00      0.00      0.00      0.00
  7    493.00    328.87      0.00      0.00      0.00      0.00
  8    493.20    400.87      0.00      0.00      0.00      0.00
  9    493.40    466.01      0.00      0.00      0.00      0.00
 10    493.60    508.09      0.00      0.00      0.00      0.00
 11    493.80    528.91      0.00      0.00      0.00      0.00
 12    494.00    550.43      0.00      0.00      0.00      0.00
 13    494.20    571.44      0.00      0.00      0.00      0.00
 14    494.40    593.99      0.00      0.00      0.00      0.00
 15    494.60    615.83      0.00      0.00      0.00      0.00
 16    494.80    638.10      0.00      0.00      0.00      0.00
 17    495.00    660.57      0.00      0.00      0.00      0.00
 18    495.20    683.39      0.00      0.00      0.00      0.00
 19    495.40    707.30      0.00      0.00      0.00      0.00
 20    495.60    731.92      0.00      0.00      0.00      0.00
 21    495.80    756.45      0.00      0.00      0.00      0.00
 22    496.00    780.75      0.00      0.00      0.00      0.00

Content Aggregated Damage Matrix.
Stream: Buechel Branch       Reach: BB-4
        Stage       APT      AUTO      COMM       PUB       RES
--- --------- --------- --------- --------- --------- ---------
  1    491.80    206.81      0.00      0.00      0.00      0.00
  2    492.00    206.81      0.00      0.00      0.00      0.00
  3    492.20    206.81      0.00      0.00      0.00      0.00
  4    492.40    206.81      0.00      0.00      0.00      0.00
  5    492.60    207.18      0.00      0.00      0.00      0.00
  6    492.80    210.42      0.00      0.00      0.00      0.00
```

7	493.00	229.80	0.00	0.00	0.00	0.00
8	493.20	269.12	0.00	0.00	0.00	0.00
9	493.40	306.95	0.00	0.00	0.00	0.00
10	493.60	333.44	0.00	0.00	0.00	0.00
11	493.80	348.26	0.00	0.00	0.00	0.00
12	494.00	364.57	0.00	0.00	0.00	0.00
13	494.20	381.50	0.00	0.00	0.00	0.00
14	494.40	400.22	0.00	0.00	0.00	0.00
15	494.60	418.32	0.00	0.00	0.00	0.00
16	494.80	436.19	0.00	0.00	0.00	0.00
17	495.00	452.47	0.00	0.00	0.00	0.00
18	495.20	466.71	0.00	0.00	0.00	0.00
19	495.40	479.92	0.00	0.00	0.00	0.00
20	495.60	492.39	0.00	0.00	0.00	0.00
21	495.80	504.57	0.00	0.00	0.00	0.00
22	496.00	517.20	0.00	0.00	0.00	0.00

Other Aggregated Damage Matrix.
Stream: Buechel Branch Reach: BB-4

	Stage	APT	AUTO	COMM	PUB	RES
1	491.80	0.00	0.00	0.00	0.00	0.00
2	492.00	0.00	0.00	0.00	0.00	0.00
3	492.20	0.00	0.00	0.00	0.00	0.00
4	492.40	0.00	0.00	0.00	0.00	0.00
5	492.60	0.00	0.00	0.00	0.00	0.00
6	492.80	0.00	0.00	0.00	0.00	0.00
7	493.00	0.00	0.00	0.00	0.00	0.00
8	493.20	0.00	0.00	0.00	0.00	0.00
9	493.40	0.00	0.00	0.00	0.00	0.00
10	493.60	0.00	0.00	0.00	0.00	0.00
11	493.80	0.00	0.00	0.00	0.00	0.00
12	494.00	0.00	0.00	0.00	0.00	0.00
13	494.20	0.00	0.00	0.00	0.00	0.00
14	494.40	0.00	0.00	0.00	0.00	0.00
15	494.60	0.00	0.00	0.00	0.00	0.00
16	494.80	0.00	0.00	0.00	0.00	0.00
17	495.00	0.00	0.00	0.00	0.00	0.00
18	495.20	0.00	0.00	0.00	0.00	0.00
19	495.40	0.00	0.00	0.00	0.00	0.00
20	495.60	0.00	0.00	0.00	0.00	0.00
21	495.80	0.00	0.00	0.00	0.00	0.00
22	496.00	0.00	0.00	0.00	0.00	0.00

Total Aggregated Damage Matrix.
Stream: Buechel Branch Reach: BB-4

	Stage	APT	AUTO	COMM	PUB	RES
1	491.80	489.50	0.00	0.00	0.00	0.00
2	492.00	489.50	0.00	0.00	0.00	0.00
3	492.20	489.50	0.00	0.00	0.00	0.00
4	492.40	489.50	0.00	0.00	0.00	0.00
5	492.60	490.74	0.00	0.00	0.00	0.00
6	492.80	501.31	0.00	0.00	0.00	0.00
7	493.00	558.66	0.00	0.00	0.00	0.00
8	493.20	669.99	0.00	0.00	0.00	0.00
9	493.40	772.95	0.00	0.00	0.00	0.00
10	493.60	841.53	0.00	0.00	0.00	0.00
11	493.80	877.16	0.00	0.00	0.00	0.00
12	494.00	915.00	0.00	0.00	0.00	0.00
13	494.20	952.93	0.00	0.00	0.00	0.00
14	494.40	994.21	0.00	0.00	0.00	0.00
15	494.60	1034.15	0.00	0.00	0.00	0.00
16	494.80	1074.29	0.00	0.00	0.00	0.00
17	495.00	1113.04	0.00	0.00	0.00	0.00
18	495.20	1150.10	0.00	0.00	0.00	0.00
19	495.40	1187.22	0.00	0.00	0.00	0.00
20	495.60	1224.31	0.00	0.00	0.00	0.00
21	495.80	1261.02	0.00	0.00	0.00	0.00
22	496.00	1297.95	0.00	0.00	0.00	0.00

Summary Output by Component With Uncertainty Errors, File “FDA_SDmg.out”

This section displays the detailed stage-aggregated damage with uncertainty results. Each table includes results for one reach, category, and component (structure, content, other, and total). These results are written to the file “FDA_SDmg.out”.

```
Stored Stage-Damage-Uncertainty Function In Data Base
     Plan.........Without
     Year.........1995
     Stream.......Buechel Branch
     Reach........BB-4
     Damage Cat...APT
     Component....Structure

Index     Stage    Damage   Std Dev
----- --------- --------- ---------
    1    491.80     282.7      28.1
    2    492.00     282.7      28.1
    3    492.20     282.7      28.1
    4    492.40     282.7      28.1
    5    492.60     283.6      28.5
    6    492.80     290.9      31.8
    7    493.00     328.9      41.4
    8    493.20     400.9      45.1
    9    493.40     466.0      38.8
   10    493.60     508.1      31.6
   11    493.80     528.9      30.4
   12    494.00     550.4      31.1
   13    494.20     571.4      31.7
   14    494.40     594.0      32.3
   15    494.60     615.8      32.8
   16    494.80     638.1      33.3
   17    495.00     660.6      33.9
   18    495.20     683.4      34.5
   19    495.40     707.3      35.2
   20    495.60     731.9      35.7
   21    495.80     756.5      36.1
   22    496.00     780.8      36.4

-------------------------------------------------------------
Stored Stage-Damage-Uncertainty Function In Data Base
     Plan.........Without
     Year.........1995
     Stream.......Buechel Branch
     Reach........BB-4
     Damage Cat...APT
     Component....Content

Index     Stage    Damage   Std Dev
----- --------- --------- ---------
    1    491.80     206.8      70.8
    2    492.00     206.8      70.8
    3    492.20     206.8      70.8
    4    492.40     206.8      70.8
    5    492.60     207.2      70.8
    6    492.80     210.4      71.1
    7    493.00     229.8      72.6
    8    493.20     269.1      74.0
    9    493.40     306.9      73.7
   10    493.60     333.4      73.4
   11    493.80     348.3      73.7
   12    494.00     364.6      74.4
   13    494.20     381.5      75.3
   14    494.40     400.2      76.3
   15    494.60     418.3      77.3
   16    494.80     436.2      78.3
   17    495.00     452.5      79.3
   18    495.20     466.7      80.2
   19    495.40     479.9      81.0
   20    495.60     492.4      81.9
   21    495.80     504.6      82.8
   22    496.00     517.2      83.7

-------------------------------------------------------------
Stored Stage-Damage-Uncertainty Function In Data Base
     Plan.........Without
     Year.........1995
     Stream.......Buechel Branch
     Reach........BB-4
```

Damage Cat...APT
Component....Other

Index	Stage	Damage	Std Dev
1	491.80	0.0	0.0
2	492.00	0.0	0.0
3	492.20	0.0	0.0
4	492.40	0.0	0.0
5	492.60	0.0	0.0
6	492.80	0.0	0.0
7	493.00	0.0	0.0
8	493.20	0.0	0.0
9	493.40	0.0	0.0
10	493.60	0.0	0.0
11	493.80	0.0	0.0
12	494.00	0.0	0.0
13	494.20	0.0	0.0
14	494.40	0.0	0.0
15	494.60	0.0	0.0
16	494.80	0.0	0.0
17	495.00	0.0	0.0
18	495.20	0.0	0.0
19	495.40	0.0	0.0
20	495.60	0.0	0.0
21	495.80	0.0	0.0
22	496.00	0.0	0.0

Stored Stage-Damage-Uncertainty Function In Data Base
Plan.........Without
Year.........1995
Stream.......Buechel Branch
Reach........BB-4
Damage Cat...APT
Component....Total

Index	Stage	Damage	Std Dev
1	491.80	489.5	77.2
2	492.00	489.5	77.2
3	492.20	489.5	77.2
4	492.40	489.5	77.2
5	492.60	490.7	77.5
6	492.80	501.3	80.2
7	493.00	558.7	89.6
8	493.20	670.0	94.4
9	493.40	773.0	88.2
10	493.60	841.5	81.7
11	493.80	877.2	80.9
12	494.00	915.0	82.0
13	494.20	952.9	83.3
14	494.40	994.2	84.5
15	494.60	1034.1	85.6
16	494.80	1074.3	86.7
17	495.00	1113.0	87.8
18	495.20	1150.1	88.8
19	495.40	1187.2	89.8
20	495.60	1224.3	90.7
21	495.80	1261.0	91.7
22	496.00	1298.0	92.7

Summary Validation Output, File FDA_SdErrors.out

The following **Table 16**(as shown in a spreadsheet) illustrates summary output from the file “FDA_SdErrors.out”. In this example, there is a total of 229 structures, 16 of which were rejected from calculations because they had a bad occupancy type. One structure used the SID Reach Name, and the remaining 212 valid structures used the calculated reach (based upon stream name, station, and bank). All of the structures used the eight water surface profiles (as opposed to the SID Reference Flood water surface profile) for aggregation purposes. To generate this table, HEC-FDA sets all flags to invalid. Then, starting from the left, as data items are validated, the flag is set to valid. For the example below, the “Out-Of_Floodplain” flag is never set to valid because the “Occupancy Codes” are bad.

Table 16 Example Structure Summary Validation Output In Spreadsheet

==
File D:\data\FDA\NewDataBase\BearTrng\FDA_SdErrors.out opened on Mon Dec 01 16:05:30 1997

Number of Structures Rejected Due To Errors In Stage-Damage Calculations
Numbers are Cumulative for Selected Plan & Year
Plan Without
Year 1995

Total Struc	Total Rejected	Struc Not Ret	Strm Bad	Rch Bad	Cat Bad	Occ Code Bad	FF Stage Undef	AggDF Not Ret	WSP Not Found	OutOf FPlain	Struc Too New	Used SID Rch	Used Calc Rch	Used SID Ref Flood	Used WSP Profiles
229	16	0	0	0	0	16	0	0	0	16	0	1	212	0	213

Additional Validation Output, TraceLevel > 1, File FDA_SdErrors.out

Table 19through Table 18show three frames (as shown in a spreadsheet) and illustrate detailed output from the file “FDA_SdErrors.out”. In this example, structure 475 is not included in the calculations because it has a bad occupancy type. Many names have an associated I.D. which is used internally within the database. When there is an illegal occupancy type, usually the occupancy type i.d. does not match one of those in the list. This can happen when the i.d. is edited by you from another product such as Visual dBASE or the occupancy type was deleted.

Table 17 Example Detailed Structure Validation Output, Frame 1

==
File D:\data\FDA\NewDataBase\BearTrng\FDA_SdErrors.out opened on Wed Dec 17 16:19:46 1997

Cum Num Struc	Struc Name	Data Not Valid	Comp Not Poss	Strm Not Valid	Rch Not Valid	Cat Not Valid	Occ Not Valid	FF Stage Bad	AggDF Not Valid	AggDF Not Scaled	WSP Not Found	Struc Too New	Struc OutOf FPlain	Stream Name
1	3192													Buechel Branch
2	3193													Buechel Branch
3	3194													Buechel Branch
4	3195													Buechel Branch
5	3196													Buechel Branch
82	471													S Fork Beargrass
83	472													S Fork Beargrass
84	473													S Fork Beargrass
85	475	x	x				x						x	S Fork Beargrass
86	476													S Fork Beargrass
87	477A													S Fork Beargrass
88	477B													S Fork Beargrass

Table 18 Example Detailed Structure Validation Output, Frame 2

Cum Num Struc	Struc Name	Stream ID	SID Rch Name Used	Curr Reach Name	Curr Rch ID	Calculated Reach Name	Calc Rch ID	SID Reach Name	SID Rch ID	Category Name	Cat ID	Occ Code Name	Occ Code ID	Uses FF Stage	1st Floor Stage	Ground Stage
1	3192	2	1	BB-4	16		0	BB-4	16	APT	6	A2S_A2C_	10	1	492.25	-901
2	3193	2	0	BB-4	16	BB-4	16	BB-4	16	APT	6	A2S_A2C_	10	1	492.25	-901
3	3194	2	0	BB-4	16	BB-4	16	BB-4	16	APT	6	A2S_A2C_	10	1	492.50	-901
4	3195	2	0	BB-4	16	BB-4	16	BB-4	16	APT	6	A2S_A2C_	10	1	492.00	-901
5	3196	2	0	BB-4	16	BB-4	16	BB-4	16	APT	6	A2S_A2C_	10	1	492.00	-901
82	471	3	0	SF-8	64	SF-8	64	SF-8	64	RES	5	1CS_1CC_	13	1	476.50	-901
83	472	3	0	SF-8	64	SF-8	64	SF-8	64	RES	5	1CS_1CC_	13	1	478.00	-901
84	473	3	0	SF-8	64	SF-8	64	SF-8	64	RES	5	1CS_1CC_	13	1	479.00	-901
85	475	3	0	SF-8	64	SF-8	64	SF-8	64	COMM	7		45	1	475.63	-901
86	476	3	0	SF-8	64	SF-8	64	SF-8	64	APT	6	A2S_A2C_	10	1	474.50	-901
87	477A	3	0	SF-8	64	SF-8	64	SF-8	64	APT	6	A2B_ABC_	46	1	473.00	-901
88	477B	3	0	SF-8	64	SF-8	64	SF-8	64	APT	6	A2B_ABC_	46	1	475.00	-901

Table 19 Example Detailed Structure Validation Output, Frame 3

Cum Num Struc	Struc Name	Foundation Height	Plan For WSP	Year For WSP	Stream For WSP	SID Ref Flood Used	Year Struc Built	Struc Station	Struc Stage Zero Damg	Max Tab Stage At Struct
1	3192	-901	Without	1995	Buechel Branch	0	1900	500.000	491.40	520.37
2	3193	-901	Without	1995	Buechel Branch	0	1900	1.790	491.40	494.78
3	3194	-901	Without	1995	Buechel Branch	0	1900	1.820	491.65	495.18
4	3195	-901	Without	1995	Buechel Branch	0	1900	1.800	491.20	494.91
5	3196	-901	Without	1995	Buechel Branch	0	1900	1.790	491.39	494.78
82	471	-901	Without	1995	S Fork Beargrass	0	1900	9.035	473.90	477.12
83	472	-901	Without	1995	S Fork Beargrass	0	1900	9.040	475.40	477.12
84	473	-901	Without	1995	S Fork Beargrass	0	1900	9.040	476.40	477.12
85	475	-901	Without	1995	S Fork Beargrass	0	1900	-901.000	-901.00	-901.00
86	476	-901	Without	1995	S Fork Beargrass	0	1900	9.030	473.40	477.11
87	477A	-901	Without	1995	S Fork Beargrass	0	1900	9.040	471.40	477.12
88	477B	-901	Without	1995	S Fork Beargrass	0	1900	9.040	473.40	477.12

Additional Structure Output, TraceLevel > 4, File FDA_SDmg.out

When "TraceLevel" is raised to five or greater, HEC-FDA adds a small amount of output to the file "FDA_SDmg.out" as shown below.

```
Structure: 3192
Stream: Buechel Branch     Reach: BB-4     Category: APT
Address: 1-24 BUECH BNK;WILLOW BROOK APT     City:                              State:

Structure: 3193
Stream: Buechel Branch     Reach: BB-4     Category: APT
Address: 105-120 BUECH BNK;WILLOW BROOK     City:                              State:

Structure: 3194
Stream: Buechel Branch     Reach: BB-4     Category: APT
Address: 89-104 BUECH BNK;WILLOW BROOK AP     City:                              State:

Structure: 3195
Stream: Buechel Branch     Reach: BB-4     Category: APT
Address: 25-49 BUECH BNK;WILLOW BROOK APT     City:                              State:
```

Detailed Structure Stage-Damage Output, TraceLevel > 9, File FDA_SDmg.out

When "TraceLevel" is set to ten or greater, HEC-FDA writes detailed output for each structure to the file "FDA_SDmg.out" Example stage-damage results at an individual structure is shown below. The "Nominal Depth" is the depth of assumed flooding without uncertainty. It corresponds to the "aggregation stages" which are shown for both the index location and at the structure as computed using either the water surface profiles or the SID reference flood water surface profile.

```
Structure: 244
Stream: S Fork Beargrass     Reach: SF-9     Category: RES
Address:                                    City:                                  State:

       WS Elev @ WS Elev @   Nominal      Mean Structure   Content     Other     Total
 Index     Index Structure     Depth     Depth    Damage    Damage    Damage    Damage
------ --------- --------- --------- --------- --------- --------- --------- ---------
     1    476.50    479.08     -6.42     -6.42      0.00      0.00      0.00      0.00
     2    477.00    479.56     -5.94     -5.94      0.00      0.00      0.00      0.00
     3    477.50    479.98     -5.52     -5.52      0.00      0.00      0.00      0.00
     4    478.00    480.36     -5.14     -5.14      0.00      0.00      0.00      0.00
     5    478.50    480.69     -4.81     -4.81      0.00      0.00      0.00      0.00
     6    479.00    481.02     -4.48     -4.48      0.00      0.00      0.00      0.00
     7    479.50    481.37     -4.13     -4.13      0.00      0.00      0.00      0.00
     8    480.00    481.73     -3.77     -3.77      0.00      0.00      0.00      0.00
     9    480.50    482.13     -3.37     -3.37      0.00      0.00      0.00      0.00
    10    481.00    482.55     -2.95     -2.95      0.00      0.00      0.00      0.00
    11    481.50    482.99     -2.51     -2.53      0.00      0.00      0.00      0.00
    12    482.00    483.40     -2.10     -2.13      0.00      0.00      0.00      0.00
    13    482.50    483.79     -1.71     -1.73      0.00      0.00      0.00      0.00
    14    483.00    484.19     -1.31     -1.33      0.07      0.01      0.00      0.08
    15    483.50    484.59     -0.91     -0.93      1.27      0.33      0.00      1.60
    16    484.00    484.99     -0.51     -0.53      4.13      1.40      0.00      5.53
    17    484.50    485.45     -0.05     -0.07      7.30      2.82      0.00     10.12
    18    485.00    485.95      0.45      0.43      8.24      4.36      0.00     12.60
    19    485.50    486.45      0.95      0.93      8.50      5.86      0.00     14.36
    20    486.00    486.95      1.45      1.43     10.37      7.11      0.00     17.48

Depth-damage function for Occupancy Code 1CS_1CC_ has no ordinates.  Component: Other.
```

Detailed Monte-Carlo Simulation Results, TraceLevel > 49, File FDA_SDev.out

When "TraceLevel" is fifty or greater, detailed Monte-Carlo Simulation results are written to the file "FDA_SDev.out". Table 20displays results for one structure. The results label "mean" are the computed means after simulation. Currently, HEC-FDA resets the "seed" number to the initial default value for every stage ordinate. This creates a bias in the results. If the seed number were not reset, the computed damage does not always increase with increasing stages. Table 20 displays the results in spreadsheet format but HEC-FDA writes the results as a normal text file (not tab delimited text).

Table 20 Example Detailed Monte-Carlo Simulation Results For One Structure

==

File D:\data\FDA\NewDataBase\BearTrng\FDA_SDev.out opened on Mon Dec 01 17:10:58 1997

Study: Beargrass Creek
Description: S. Fork Beargrass & Buechel Branch
Pathname: D:\data\FDA\NewDataBase\BearTrng
Plan: Without
Year: 1995
Structure: 3192
Stream: Buechel Branch Reach: BB-4 Category: APT
Address: 1-24 BUECH BNK;WILLOW BROOK APT City: State:

Monte Carlo Simulation Results for First Floor Elevation and Values

Index	Nominal 1st Floor Elev	Mean 1stFloor Elev	StdDev 1stFloor Elev	Num of Simul	Mean Struct Value	StdDev Struct Value	Num of Simul	Mean Content Value	StdDev Content Value	Num of Simul	Mean Other Value	StdDev Other Value	Num of Simul	Mean Total Value	StdDev Total Value	Num of Simul
1	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
2	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
3	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
4	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
5	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
6	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
7	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
8	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
9	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
10	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
11	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
12	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
13	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
14	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
15	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
16	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
17	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
18	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
19	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
20	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
21	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100
22	492.25	492.27	0.206	100	743.91	73.904	100	356.57	122.067	100	0	0	100	1100.48	145.249	100

Example Detailed Structure Output in Spreadsheet Format, File FDA_StrucDetail.out

The following pages illustrate the output file "FDA_StrucDetail.out". It is divided into several frames - each one representing part of the total width of the spreadsheet which is about 60 columns wide. The following displays reflect the look of the file after it is imported into a spreadsheet as a tab-delimited text file. Subsequent frames repeat the first column which is the structure name. The row whose first column contains the keyword "Struc_Name" is the row which contains codes required for importing data back into the HEC-FDA database as a "tab-delimited, ASCII text file". For import, the row containing the key words must be the first row and the structure data must begin in the row immediately following it.

Frame 1

===
File D:\data\FDA\NewDataBase\BearTrng\FDA_StrucDetail.out opened on Mon Dec 01 17:10:58 1997

Study: Beargrass Creek
Description: S. Fork Beargrass & Buechel Branch
Pathname: D:\data\FDA\NewDataBase\BearTrng
Plan: Without
Year: 1995

Structure Name	Stream Name	Reach Name	Station	Bank	Year In Service	Damage Category	Occupancy Type	Street	City	State	Zip
Struc_Name	Stream_Name		Station	Bank	Year	Cat_Name	Occ_Name	Street	City	State	Zip
3192	Buechel Branch	BB-4	500.000	Left	1900	APT	A2S_A2C_	1-24 BUECH BNK;WILLOW BROOK APT			
3193	Buechel Branch	BB-4	1.790	Left	1900	APT	A2S_A2C_	105-120 BUECH BNK;WILLOW BROOK			
3194	Buechel Branch	BB-4	1.820	Left	1900	APT	A2S_A2C_	89-104 BUECH BNK;WILLOW BROOK AP			
3195	Buechel Branch	BB-4	1.800	Left	1900	APT	A2S_A2C_	25-49 BUECH BNK;WILLOW BROOK APT			
3196	Buechel Branch	BB-4	1.790	Left	1900	APT	A2S_A2C_	WILLOW BROOK APTS CLUBHOUSE			
3197	Buechel Branch	BB-4	1.823	Left	1900	APT	A2S_A2C_	65-77 BUECH BNK;WILLOW BROOK APT			
3198	Buechel Branch	BB-4	1.840	Left	1900	APT	A2S_A2C_	49-56 BUECH BNK;WILLOW BROOK APT			
3199	Buechel Branch	BB-4	1.835	Left	1900	APT	A2S_A2C_	57-65 BUECH BNK;WILLOW BROOK APT			
3215	Buechel Branch	BB-5	2.055	Left	1900	COMM	13S_13C_	4133 BTOWN RD;CHAMPION WINDOWS			
3216	Buechel Branch	BB-5	2.950	Left	1900	RES	2BS_2BC_	2209 FAIRLAND AV.			
3217	Buechel Branch	BB-5	2.215	Left	1900	RES	1CS_1CC_	2222 FAIRLAND AV.			
3218	Buechel Branch	BB-5	2.165	Left	1900	RES	1CS_1CC_	2220 FAIRLAND AV.			
3219	Buechel Branch	BB-5	2.160	Left	1900	RES	1CS_1CC_	2220 FAIRLAND AV.			
3220	Buechel Branch	BB-5	2.135	Left	1900	RES	1CS_1CC_	2216 FAIRLAND AV.			
3221	Buechel Branch	BB-5	2.110	Left	1900	RES	2BS_2BC_	2212 FAIRLAND AV.			
3222	Buechel Branch	BB-5	2.090	Left	1900	COMM	83S_83C_	FAIRLAND AV. storage whse.			
3223	Buechel Branch	BB-5	2.130	Left	1900	RES	1CS_1CC_	FAIRLAND AV.; BI-30			
3224	Buechel Branch	BB-5	2.135	Left	1900	RES	2BS_2BC_	2215 FAIRLAND AV.; BI-30			
3225	Buechel Branch	BB-5	2.150	Left	1900	RES	2CS_2CC_	2217 FAIRLAND AV.; BI-30			
3226	Buechel Branch	BB-5	2.220	Left	1900	RES	2CS_2CC_	2224 FAIRLAND AV.; BI-30			
3228	Buechel Branch	BB-5	2.450	Left	1900	RES	1CS_1CC_	BI-30; BEARGRASS AV			
399	S Fork Beargrass	SF-8	9.900	Left	1900	COMM	30S_30C_	BASHFORD MANOR MALL			

Frame 2

Structure Name	Northing	Easting	Zone	Module	Structure Value in Database	Structure Value	Content Value in Database	Ratio Content / Structure Value in Database	Content Value	Ratio Content / Structure Value	Other Value in Database	Ratio Other / Structure Value in Database	Other Value
Struc_Name	North	East	Zone	Mod_Name	Struc_Val		Cont_Val				Other_Val		
3192	0	0	1.75	Base	$737.8	$737.8	$368.9	50.0	$368.9	50.0	-$901.0	-901.0	$0.0
3193	0	0	-901	Base	$513.6	$513.6	$256.8	50.0	$256.8	50.0	-$901.0	-901.0	$0.0
3194	0	0	-901	Base	$517.7	$517.7	$258.9	50.0	$258.9	50.0	-$901.0	-901.0	$0.0
3195	0	0	-901	Base	$743.9	$743.9	$372.0	50.0	$372.0	50.0	-$901.0	-901.0	$0.0
3196	0	0	-901	Base	$87.6	$87.6	$43.8	50.0	$43.8	50.0	-$901.0	-901.0	$0.0
3197	0	0	-901	Base	$538.0	$538.0	$269.0	50.0	$269.0	50.0	-$901.0	-901.0	$0.0
3198	0	0	-901	Base	$265.0	$265.0	$132.5	50.0	$132.5	50.0	-$901.0	-901.0	$0.0
3199	0	0	-901	Base	$265.0	$265.0	$132.5	50.0	$132.5	50.0	-$901.0	-901.0	$0.0
3215	0	0	-901	Base	$75.0	$75.0	$60.0	50.0	$60.0	80.0	-$901.0	-901.0	$0.0
3216	0	0	-901	Base	$56.7	$56.7	$28.3	50.0	$28.3	50.0	-$901.0	-901.0	$0.0
3217	0	0	-901	Base	$64.9	$64.9	$32.5	-901.0	$32.5	50.0	-$901.0	-901.0	$0.0
3218	0	0	-901	Base	$77.3	$77.3	$38.6	-901.0	$38.6	50.0	-$901.0	-901.0	$0.0
3219	0	0	-901	Base	$34.0	$34.0	$17.0	-901.0	$17.0	50.0	-$901.0	-901.0	$0.0
3220	0	0	-901	Base	$62.8	$62.8	$31.4	-901.0	$31.4	50.0	-$901.0	-901.0	$0.0
3221	0	0	-901	Base	$74.2	$74.2	$37.1	50.0	$37.1	50.0	-$901.0	-901.0	$0.0
3222	0	0	-901	Base	$36.0	$36.0	$28.8	50.0	$28.8	80.0	-$901.0	-901.0	$0.0
3223	0	0	-901	Base	$22.7	$22.7	$11.3	-901.0	$11.3	50.0	-$901.0	-901.0	$0.0
3224	0	0	-901	Base	$54.6	$54.6	$27.3	50.0	$27.3	50.0	-$901.0	-901.0	$0.0
3225	0	0	-901	Base	$26.8	$26.8	$13.4	50.0	$13.4	50.0	-$901.0	-901.0	$0.0
3226	0	0	-901	Base	$44.3	$44.3	$22.2	50.0	$22.2	50.0	-$901.0	-901.0	$0.0
3228	0	0	-901	Base	$16.5	$16.5	$8.2	-901.0	$8.2	50.0	-$901.0	-901.0	$0.0
399	0	0	-901	Base	$73,700.0	$73,700.0	$36,850.0	50.0	$36,850.0	50.0	-$901.0	-901.0	$0.0

Frame 3

Structure Name	Ratio Other / Structure Value	Total Value	Number of Structures	First Floor Elevation	Ground Elevation	Foundation Height	Depth at Beginning Damage	Stage at Zero Damage	Depth at zero damage	SID Reach Name	SID Ref Flood Stage
Struc_Name			Num_Struct	1F_Stage	Grnd_Stage	Found_Ht	Begin_Damg			SID_Rch	SID_Reffld
3192	0.0	$1,106.7	1	492.25			-0.25	492.00	-0.25	BB-4	493.70
3193	0.0	$770.4	1	492.25			-0.25	492.00	-0.25	BB-4	494.10
3194	0.0	$776.6	1	492.50			-0.25	492.25	-0.25	BB-4	494.50
3195	0.0	$1,115.9	1	492.00			-0.20	491.80	-0.20	BB-4	494.30
3196	0.0	$131.4	1	492.00			-0.01	491.99	-0.01	BB-4	494.10
3197	0.0	$807.0	1	492.25			-0.25	492.00	-0.25	BB-4	494.50
3198	0.0	$397.5	1	492.50			-0.25	492.25	-0.25	BB-4	494.70
3199	0.0	$397.5	1	492.50			-0.25	492.25	-0.25	BB-4	494.70
3215	0.0	$135.0	1	502.30			-0.01	502.30	0.00	BB-5	502.00
3216	0.0	$85.0	1	505.00			-3.00	502.00	-3.00	BB-5	501.90
3217	0.0	$97.3	1	504.25			-2.25	502.25	-2.00	BB-5	502.60
3218	0.0	$115.9	1	501.50			-1.00	500.50	-1.00	BB-5	502.30
3219	0.0	$51.0	1	500.00			-0.01	499.99	-0.01	BB-5	502.20
3220	0.0	$94.2	1	502.25			-2.25	500.25	-2.00	BB-5	502.20
3221	0.0	$111.2	1	507.00			-6.00	501.00	-6.00	BB-5	502.10
3222	0.0	$64.8	1	500.20			-0.01	500.20	0.00	BB-5	502.10
3223	0.0	$34.0	1	504.25			-2.25	502.25	-2.00	BB-5	502.20
3224	0.0	$81.9	1	506.00			-4.00	502.00	-4.00	BB-5	502.20
3225	0.0	$40.2	1	503.75			-1.25	502.50	-1.25	BB-5	502.20
3226	0.0	$66.4	1	503.75			-1.25	502.50	-1.25	BB-5	502.60
3228	0.0	$24.7	1	510.00			-2.00	508.00	-2.00	BB-5	507.40
399	0.0	$110,550.0	1	476.99			-0.01	476.99	0.00	SF-8	476.20

Frame 4

Structure Name	Stage at 0.5 Probability	Stage at 0.2 Probability	Stage at 0.1 Probability	Stage at 0.04 Probability	Stage at 0.02 Probability	Stage at 0.01 Probability	Stage at 0.004 Probability	Stage at 0.002 Probability	Depth at 0.5 Probability	Depth at 0.2 Probability
	0.500	0.200	0.100	0.040	0.020	0.010	0.004	0.002	0.500	0.200
Struc_Name										
3192	515.78	516.92	518.41	518.83	519.05	519.33	519.54	520.32	23.53	24.67
3193	490.26	491.04	492.07	493.06	493.46	493.89	494.14	494.73	-2.00	-1.21
3194	490.81	491.59	492.52	493.38	493.78	494.23	494.49	495.13	-1.69	-0.91
3195	490.44	491.22	492.22	493.17	493.57	494.00	494.26	494.86	-1.56	-0.78
3196	490.26	491.04	492.07	493.06	493.46	493.89	494.14	494.73	-1.75	-0.96
3197	490.87	491.64	492.56	493.41	493.81	494.26	494.53	495.17	-1.38	-0.61
3198	491.19	491.95	492.81	493.59	493.99	494.45	494.73	495.40	-1.31	-0.55
3199	491.09	491.86	492.74	493.54	493.94	494.39	494.67	495.33	-1.41	-0.64
3215	497.23	499.56	501.30	501.58	501.73	501.92	502.03	502.32	-5.07	-2.74
3216	515.78	516.92	518.41	518.83	519.05	519.33	519.54	520.32	10.78	11.92
3217	498.94	500.17	501.49	501.86	502.10	502.40	502.58	503.06	-5.31	-4.08
3218	498.04	499.85	501.37	501.69	501.88	502.12	502.27	502.65	-3.46	-1.66
3219	497.97	499.83	501.36	501.68	501.86	502.10	502.25	502.62	-2.03	-0.17
3220	497.65	499.76	501.34	501.64	501.81	502.02	502.16	502.51	-4.60	-2.50
3221	497.54	499.73	501.32	501.61	501.78	501.99	502.11	502.43	-9.46	-7.27
3222	497.45	499.71	501.31	501.60	501.76	501.96	502.08	502.38	-2.75	-0.49
3223	497.63	499.75	501.33	501.63	501.80	502.02	502.15	502.49	-6.62	-4.50
3224	497.65	499.76	501.34	501.64	501.81	502.02	502.16	502.51	-8.35	-6.25
3225	497.82	499.79	501.35	501.66	501.84	502.06	502.21	502.57	-5.93	-3.96
3226	499.04	500.22	501.50	501.89	502.13	502.44	502.63	503.11	-4.71	-3.53
3228	504.44	505.14	505.86	506.43	506.77	507.19	507.40	507.98	-5.56	-4.86
399	470.09	471.54	473.23	474.44	475.01	475.74	476.19	477.48	-6.90	-5.46

Frame 5

Structure Name	Depth at 0.1 Probability	Depth at 0.04 Probability	Depth at 0.02 Probability	Depth at 0.01 Probability	Depth at 0.004 Probability	Depth at 0.002 Probability	Total Damage at 0.5 Probability	Total Damage at 0.2 Probability	Total Damage at 0.1 Probability	Total Damage at 0.04 Probability
	0.100	0.040	0.020	0.010	0.004	0.002	0.500	0.200	0.100	0.040
Struc_Name										
3192	26.16	26.58	26.80	27.08	27.29	28.07	$494.3	$494.3	$494.3	$494.3
3193	-0.18	0.81	1.21	1.64	1.89	2.48	$0.0	$0.0	$49.4	$71.0
3194	0.01	0.88	1.28	1.73	1.99	2.63	$0.0	$0.0	$57.2	$72.9
3195	0.22	1.16	1.57	2.00	2.26	2.86	$0.0	$0.0	$87.5	$117.1
3196	0.07	1.06	1.46	1.89	2.14	2.73	$0.0	$0.0	$9.8	$13.1
3197	0.31	1.16	1.56	2.01	2.28	2.92	$0.0	$0.0	$65.0	$84.5
3198	0.31	1.09	1.49	1.95	2.23	2.89	$0.0	$0.0	$32.1	$40.3
3199	0.24	1.04	1.44	1.89	2.17	2.83	$0.0	$0.0	$31.4	$39.2
3215	-1.00	-0.72	-0.57	-0.38	-0.27	0.02	$0.0	$0.0	$0.0	$0.0
3216	13.41	13.83	14.05	14.33	14.54	15.32	$50.6	$53.6	$55.9	$56.2
3217	-2.76	-2.39	-2.16	-1.85	-1.67	-1.19	$0.0	$0.0	$0.0	$0.0
3218	-0.13	0.19	0.38	0.62	0.77	1.15	$0.0	$0.0	$14.2	$17.1
3219	1.36	1.68	1.86	2.10	2.25	2.62	$0.0	$0.0	$10.8	$12.3
3220	-0.91	-0.61	-0.45	-0.23	-0.09	0.26	$0.0	$0.0	$1.7	$5.5
3221	-5.68	-5.39	-5.22	-5.01	-4.89	-4.57	$0.0	$0.0	$2.6	$2.9
3222	1.11	1.40	1.56	1.76	1.88	2.18	$0.0	$0.0	$12.1	$14.8
3223	-2.92	-2.62	-2.45	-2.23	-2.10	-1.76	$0.0	$0.0	$0.0	$0.0
3224	-4.66	-4.36	-4.20	-3.98	-3.84	-3.49	$0.0	$0.0	$0.0	$0.0
3225	-2.40	-2.09	-1.91	-1.69	-1.54	-1.18	$0.0	$0.0	$0.0	$0.0
3226	-2.25	-1.86	-1.62	-1.31	-1.13	-0.64	$0.0	$0.0	$0.0	$0.0
3228	-4.14	-3.57	-3.23	-2.81	-2.60	-2.02	$0.0	$0.0	$0.0	$0.0
399	-3.76	-2.55	-1.98	-1.25	-0.81	0.49	$0.0	$0.0	$0.0	$0.0

Frame 6

Structure Name	Total Damage at 0.02 Probability	Total Damage at 0.01 Probability	Total Damage at 0.004 Probability	Total Damage at 0.002 Probability	Structure Damage at 0.5 Probability	Structure Damage at 0.2 Probability	Structure Damage at 0.1 Probability	Structure Damage at 0.04 Probability	Structure Damage at 0.02 Probability	Structure Damage at 0.01 Probability
	0.020	0.010	0.004	0.002	0.500	0.200	0.100	0.040	0.020	0.010
Struc_Name										
3192	$494.3	$494.3	$494.3	$494.3	$280.4	$280.4	$280.4	$280.4	$280.4	$280.4
3193	$82.6	$99.2	$108.8	$131.3	$0.0	$0.0	$32.7	$44.2	$50.6	$59.4
3194	$85.8	$103.2	$113.7	$138.2	$0.0	$0.0	$36.4	$45.3	$52.3	$61.6
3195	$139.5	$163.9	$178.1	$211.6	$0.0	$0.0	$55.3	$71.8	$83.8	$96.9
3196	$15.7	$18.6	$20.2	$24.0	$0.0	$0.0	$6.2	$8.1	$9.5	$11.0
3197	$100.6	$118.7	$129.6	$155.4	$0.0	$0.0	$41.0	$51.9	$60.5	$70.2
3198	$48.1	$57.2	$62.9	$76.1	$0.0	$0.0	$20.2	$24.8	$29.0	$33.9
3199	$47.1	$56.1	$61.7	$74.8	$0.0	$0.0	$19.8	$24.3	$28.5	$33.3
3215	$0.0	$0.0	$0.0	$0.7	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3216	$56.4	$56.4	$56.4	$56.4	$30.9	$32.2	$33.7	$33.9	$34.0	$34.0
3217	$0.0	$0.1	$0.2	$0.5	$0.0	$0.0	$0.0	$0.0	$0.0	$0.1
3218	$18.0	$19.1	$19.8	$22.4	$0.0	$0.0	$10.2	$11.6	$11.6	$11.6
3219	$13.1	$13.9	$14.1	$14.6	$0.0	$0.0	$6.2	$7.2	$7.7	$8.3
3220	$7.6	$10.3	$12.1	$14.2	$0.0	$0.0	$1.4	$4.0	$5.5	$7.4
3221	$3.1	$3.3	$3.5	$3.8	$0.0	$0.0	$1.7	$1.9	$2.1	$2.2
3222	$16.4	$18.4	$19.5	$20.7	$0.0	$0.0	$1.0	$1.3	$1.5	$1.7
3223	$0.0	$0.0	$0.0	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3224	$0.0	$3.3	$3.3	$3.4	$0.0	$0.0	$0.0	$0.0	$0.0	$2.2
3225	$0.0	$0.0	$0.0	$0.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3226	$0.0	$0.0	$1.4	$2.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3228	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
399	$0.0	$0.0	$0.0	$4,300.4	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Frame 7

Structure Name	Structure Damage at 0.004 Probability	Structure Damage at 0.002 Probability	Content Damage at 0.5 Probability	Content Damage at 0.2 Probability	Content Damage at 0.1 Probability	Content Damage at 0.04 Probability	Content Damage at 0.02 Probability	Content Damage at 0.01 Probability	Content Damage at 0.004 Probability	Content Damage at 0.002 Probability
	0.004	0.002	0.500	0.200	0.100	0.040	0.020	0.010	0.004	0.002
Struc_Name										
3192	$280.4	$280.4	$214.0	$214.0	$214.0	$214.0	$214.0	$214.0	$214.0	$214.0
3193	$64.5	$79.0	$0.0	$0.0	$16.8	$26.8	$32.1	$39.8	$44.3	$52.3
3194	$67.2	$83.5	$0.0	$0.0	$20.8	$27.5	$33.5	$41.6	$46.5	$54.7
3195	$106.3	$128.7	$0.0	$0.0	$32.2	$45.2	$55.7	$67.0	$71.8	$82.9
3196	$12.0	$14.6	$0.0	$0.0	$3.6	$5.0	$6.2	$7.6	$8.2	$9.5
3197	$77.4	$94.6	$0.0	$0.0	$24.0	$32.6	$40.1	$48.5	$52.2	$60.8
3198	$37.5	$46.3	$0.0	$0.0	$11.8	$15.4	$19.1	$23.4	$25.4	$29.8
3199	$36.7	$45.4	$0.0	$0.0	$11.5	$14.9	$18.6	$22.8	$25.0	$29.3
3215	$0.0	$0.2	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.5
3216	$34.0	$34.0	$19.7	$21.4	$22.2	$22.3	$22.4	$22.4	$22.4	$22.4
3217	$0.2	$0.5	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3218	$11.6	$12.6	$0.0	$0.0	$4.0	$5.5	$6.4	$7.5	$8.2	$9.8
3219	$8.4	$8.8	$0.0	$0.0	$4.6	$5.1	$5.4	$5.6	$5.7	$5.8
3220	$8.6	$9.4	$0.0	$0.0	$0.3	$1.5	$2.1	$2.9	$3.4	$4.7
3221	$2.3	$2.5	$0.0	$0.0	$0.9	$1.0	$1.0	$1.1	$1.2	$1.3
3222	$1.8	$2.0	$0.0	$0.0	$11.0	$13.5	$14.9	$16.6	$17.7	$18.7
3223	$0.0	$0.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3224	$2.2	$2.2	$0.0	$0.0	$0.0	$0.0	$0.0	$1.1	$1.1	$1.2
3225	$0.0	$0.8	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3226	$1.4	$2.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.6
3228	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
399	$0.0	$1,075.1	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$3,225.3

Frame 8

Structure Name	Other Damage at 0.5 Probability	Other Damage at 0.2 Probability	Other Damage at 0.1 Probability	Other Damage at 0.04 Probability	Other Damage at 0.02 Probability	Other Damage at 0.01 Probability	Other Damage at 0.004 Probability	Other Damage at 0.002 Probability
	0.500	0.200	0.100	0.040	0.020	0.010	0.004	0.002
Struc_Name								
3192	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3193	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3194	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3195	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3196	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3197	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3198	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3199	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3215	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3216	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3217	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3218	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3219	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3220	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3221	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3222	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3223	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3224	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3225	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3226	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
3228	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
399	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Frame 9

Structure Name		
Struc_Name	Notes	ImageFName
3192	E:	D:\\WINHEC\fda\house3.gif
3193	E:\DATA\FDA\BearTrng\BB95A.S	
3194	E:\DATA\FDA\BearTrng\BB95A.S	
3195	E:\DATA\FDA\BearTrng\BB95A.S	
3196	E:\DATA\FDA\BearTrng\BB95A.S	
3197	E:\DATA\FDA\BearTrng\BB95A.S	
3198	E:\DATA\FDA\BearTrng\BB95A.S	
3199	E:\DATA\FDA\BearTrng\BB95A.S	
3215	E:\DATA\FDA\BearTrng\BB95A.S	
3216	E:\DATA\FDA\BearTrng\BB95A.S	
3217	E:\DATA\FDA\BearTrng\BB95A.S	
3218	E:\DATA\FDA\BearTrng\BB95A.S	
3219	E:\DATA\FDA\BearTrng\BB95A.S	
3220	E:\DATA\FDA\BearTrng\BB95A.S	
3221	E:\DATA\FDA\BearTrng\BB95A.S	
3222	E:\DATA\FDA\BearTrng\BB95A.S	
3223	E:\DATA\FDA\BearTrng\BB95A.S	
3224	E:\DATA\FDA\BearTrng\BB95A.S	
3225	E:\DATA\FDA\BearTrng\BB95A.S	
3226	E:\DATA\FDA\BearTrng\BB95A.S	
3228	E:\DATA\FDA\BearTrng\BB95A.S	
399	E:\DATA\FDA\BearTrng\SF95A.S	